5.2.3.3 NorthMet Project Proposed Action Wetland Impact Avoidance, Minimization, Mitigation, and Monitoring Measures

This section discusses measures that were taken to avoid and minimize wetland ~~effects~~impacts, evaluates PolyMet's proposed wetland mitigation for unavoidable ~~effects~~impacts, discusses other potential mitigation measures that may benefit wetlands, and identifies key elements of a wetland monitoring plan. The wetland impact, avoidance, minimization, mitigation and monitoring plan presented in the EIS would be reviewed and approved during permitting; therefore, the mitigation and proposed monitoring could change during permitting.

5.2.3.3.1 Wetland Avoidance and Minimization

Section 404 regulations of the CWA, Minnesota's WCA rules, and Minnesota's water quality standards rules at Minn. R. 7050.0186 requires that impacts to wetlands be avoided and minimized to the extent practicable, and if wetland impacts cannot be avoided and/or minimized, then compensatory mitigation practices would be necessary.

Final regulations and guidelines associated with Section 404 of the CWA require that project proponents eliminate or reduce adverse impacts to waters of the United States by taking certain specific steps during project planning: 1) modify the project to avoid adverse impacts; 2) incorporate measures to minimize adverse impacts; and 3) compensate for unavoidable adverse impacts through restoration, enhancement, creation, or in-lieu fee.

PolyMet proposes to avoid and minimize wetland ~~effects~~ impacts through a number of measures that are incorporated into the proposed mine plan. Direct wetland impacts at the Mine Site have been reduced during the development of the NorthMet Project Proposed Action. Modifications to the NorthMet Project Proposed Action that have occurred during the development of the EIS have resulted in avoidance and minimization of impacts on wetland resources. To date, these modifications have reduced the acreage of wetlands impacted from 1,257 to 913.8 acres, a 27 percent decrease.

At the Mine Site, waste rock would be placed back into the East Pit and Central Pit after year 11, thereby reducing the need for additional surface stockpile areas that would otherwise affect wetlands. In addition, PolyMet proposes to combine the saturated overburden and temporary stockpiles that contain membrane liners, which were separate in the original NorthMet Project Proposed Action design. The Overburden Storage and Laydown Area would only store peat and unsaturated overburden (PolyMet ~~2013c~~2015a). By reducing the footprint of the Overburden Storage and Laydown Area and stockpiles, direct wetland ~~effects~~ impacts were reduced. Similarly, PolyMet proposes to move the Category 4 Stockpile to the footprint of the Central Pit, which would be mined later and thus avoid additional direct wetland ~~effects~~impacts. Reactive waste rock stockpiles would be lined, and stormwater runoff that contacted reactive rock would be contained to help prevent water quality-related effects on adjacent wetlands. In addition, hydrologic effects would be reduced by the use of seepage control measures, which would be installed at the mine pits to restrict shallow groundwater movement through higher permeability areas and help prevent drawdown of wetland water levels near mine pits. Haul road construction/layout has been re-configured to have fewer haul roads and locations thereby reducing land and wetland disturbance and truck distance to be driven. Haul road construction would include placement of large rocks as a foundation to allow shallow subsurface groundwater

flowpaths in the wetlands to be maintained within the active areas of the Mine Site between the pits and stockpiles.

Specifically, utilizing existing Plant Site infrastructure, the existing LTVSMC Tailings Basin, and the Transportation and Utility Corridor all serve as avoidance measures since building these on undeveloped sites could ~~affect~~ impact at least hundreds of acres of additional wetlands. Reusing existing infrastructure limits wetland ~~effects~~ impacts from these activities to previously disturbed areas. Additionally, cutoff berms/walls, trenches, and sump and pump systems would be used to collect current and future surface seepage from around the toe of the Tailings Basin (PolyMet 2011m). This surface seepage would ultimately be re-routed to the Tailings Basin, thus avoiding or minimizing discharges to surrounding wetlands. Construction of the containment system, however, would reduce the amount of seepage flowing to four tributaries of the Embarrass River (PolyMet ~~2013c~~2015a). Streamflow would be augmented using WWTP effluent ~~and water from Colby Lake~~ so that the target annual average flow that supports existing wetland hydrology would be met.

5.2.3.3.2 Wetland Mitigation

As previously noted, jurisdictional wetlands are regulated under state and federal laws, including the WCA (*Minnesota Rules* Chapter 8420), *Minnesota Rules*, part 7050.0186, and Sections 401 and 404 of the CWA. In addition, some wetlands are also designated as Minnesota Public Waters and subject to the Public Waters Work Permit Rules (*Minnesota Rules* Chapter 6115). However, no public water wetlands would be ~~affected~~ impacted by the NorthMet Project Proposed Action.

Both the state and federal wetland regulations require that a permit, approval, and/or certification be issued by the regulatory agency for wetland ~~effects~~ impacts as defined by the respective regulations. The USACE St. Paul District is the permitting authority for the DA permit pursuant to Section 404 of the CWA; the MDNR Division of Lands and Minerals administers the WCA approval process as part of the Permit to Mine (*Minnesota Rules*, part 8420.0200, subpart 1D); and the MPCA has authority under Section 401 of the CWA to certify that discharges authorized under Section 404 comply with water quality standards.

The wetland mitigation planning process relied on the WCA wetland replacement siting rules (*Minnesota Rules* part 8420.0522), ~~state~~ compensatory mitigation requirements under state water quality standards (*Minnesota Rules* part 7050.0186), and the USACE *St. Paul District Policy for Wetland Compensatory Mitigation in Minnesota* (2009)~~, which prioritizes the location of project-specific compensation to first replace lost wetlands on-site, then within the same watershed or county, and finally within adjacent watersheds.~~

Sequencing

The compensatory wetland mitigation site selection for the NorthMet Project Proposed Action began in 2005 and has gone through a rigorous site selection evaluation. Prior to the 2008 Federal Mitigation Rule, the Aitkin and Hinckley sites were selected, initial approvals by the regulatory agencies were received, and substantial investments were made by PolyMet, to develop both sites for compensatory mitigation. The USACE guidance that was utilized prior to the implementation of the Federal Mitigation Rule 2008 was to look for mitigation sites that could provide the following: restoration of historical wetlands, high probability of success, achieves at least partial in-kind mitigation and sites that had ditched and/or tiled peatlands to provide for restoration. When the Federal Mitigation Rule 2008 went into effect, the USACE

informed PolyMet of the priority for siting any future compensatory mitigation within the St. Louis River/Great Lakes Basin. The Zim site was subsequently proposed as a third site. The Proponent, along with, in some cases, state and federal agencies, have conducted and are continuing to conduct extensive efforts to find additional suitable sites within in the Great Lakes Basin for wetland mitigation.

The Federal Mitigation Rule 2008 and USACE St. Paul District Policy 2009 specifies a preferential sequence for compensatory mitigation (i.e., use of mitigation banking credits, use of project-specific compensation that is based on a watershed approach, use of project-specific compensation that is on-site and in-kind, and use of project-specific compensation that is off-site and/or out-of-kind), and aims to select mitigation sites as close as possible to the watershed of impact; however, sometimes this cannot be accomplished. The USACE St. Paul District Policy 2009 accepts out-of-watershed mitigation; however, the USACE's preference is for the mitigation to be within the same watershed as a proposed project. The term "watershed approach" is defined in 33 USC § 332.2 as "an analytical process for making compensatory mitigation decisions that support the sustainability or improvement of aquatic resources in a waters. It involves consideration of watershed needs, and how locations and types of compensatory mitigation projects address those needs. "

As such, the compensatory mitigation approach by PolyMet followed the USACE St. Paul District Policy 2009 in effect at the time the proposed compensation sites were selected. Further, the Zim site was developed in accordance with a watershed approach. In combination, the proposed compensatory mitigation is appropriate for the siting and scale of the impacts that would result from the NorthMet Project Proposed Action. As noted above for the project-specific compensation, the following compensatory mitigation siting sequence is required: on-site, in the same 10-digit HUC watershed, in same 8-digit HUC watershed, in same modified 6-digit watershed, in same 4-digit HUC watershed, then statewide.

While on-site replacement of wetlands is listed first in the sequencing, on-site conditions may not be the most suitable for successful wetland mitigation. In fact, 33 USC § 332.3(b) states that compensatory mitigation should be located where it is most likely to successfully replace lost functions and services within the watershed, not specifically on-site. Moreover, the preferred mitigation methodology stated under the Federal Mitigation Rule 2008 begins with the utilization of mitigation banks and in-lieu fee programs within appropriate service areas prior to permittee-responsible mitigation (33 USC § 332.3(b)(2)-(3)). Following the use of mitigation banks and in-lieu fee programs, the Federal Mitigation Rule 2008 clearly states that permittee-responsible mitigation following a watershed approach (i.e., providing for mitigation in the best suitable location within the proposed impact watershed) should be used (33 USC § 332.3(b)(4)). Only after mitigation banks, in-lieu fee programs (where available), and permittee-responsible mitigation under a watershed approach have been exhausted or are infeasible should permittee-responsible mitigation through on-site and in-kind mitigation be considered (33 USC § 332.3(b)(5).

Compensatory mitigation is defined as restoration (reestablishment or rehabilitation), establishment (creation), enhancement, and/or, in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved (33 CFR § 332.2). When comparing the alternatives, restoration is the best approach for replacing lost functions; preservation does not replace the lost functions and creation is both slow to replace the functions

and has a lower degree of success. Restoration should generally be the first option considered because the likelihood of success is greater and the impacts to potentially ecologically important uplands are reduced compared to establishment. Also, the potential gains in terms of aquatic resource functions are greater, compared to enhancement and preservation (33 CFR § 332.3(a)(2) and 40 CFR § 230.93(a)(2)). Furthermore, the USACE St. Paul District Policy 2009 guidance states that restoration is the preferred compensatory mitigation technique. Restoration sites historically supported wetlands and frequently retain some wetland components (e.g., hydric soils) even after man-made disturbances such as drainage and cropping. Restoration also applies to increasing the functional level of existing, degraded wetlands. Restoration through re-establishment involves techniques for returning wetland functions to a location where no wetland currently exists. This technique results in a gain in both wetland acres and wetland functions.

The primary goal of wetland mitigation is to restore high-quality wetland communities of the same type, quality, and function~~, and value~~ as those to be ~~affected~~ impacted to the extent practicable. To achieve that goal, state and federal guidelines were followed during the wetland mitigation planning process, with a preference placed on restoring drained wetlands over creating wetlands. The five main categories of mitigation methods considered appropriate in northern Minnesota by state and federal agencies were 1) restoration of former or degraded wetlands, 2) enhancement of existing wetlands, 3) wetland preservation, 4) wetland creation, and 5) upland buffers.

USACE Mitigation Ratios and Financial Assurance

The USACE St. Paul District Policy ~~for Wetland Compensatory Mitigation in Minnesota (~~2009~~)~~ applies three factors to determine compensation ratios: in-place versus out-of-place, in-kind versus out-of-kind, and in-advance versus not in-advance. These factors are defined as follows:

- In-place mitigation means the replacement of the impacted aquatic site would take place in the same 8-digit Hydrologic Unit Code (HUC) watershed as the proposed ~~affected~~ impacted resource. The USACE St. Paul District Policy uses the term "in-place" to include on-site, which is defined as an area located on the same parcel of land as the impact site, or on a parcel of land contiguous to the impact site.
- Out-of-place mitigation means the replacement of the impacted aquatic site would take place in a different 8-digit HUC watershed as the proposed impacted resource.
- In-kind mitigation means the replacement of the impacted aquatic site with a resource of a similar structural and functional type to the impacted resource ~~one of the same hydrologic regime and plant community types~~ (same species composition).
- Out-of-kind mitigation means the replacement of an impacted aquatic site with one of a resource of a different structural and functional type from the impacted resource ~~different hydrologic regime and plant community type~~ (different species composition).
- In-advance mitigation is a form of mitigation that is designed, permitted, and constructed in advance of a permitted impact.

The temporal loss issue is addressed by the in-advance versus not-in-advance factor. The Federal Mitigation Rule 2008 states that compensation ratios of greater than 1:1 can be applied to account for factors including temporal loss and the difficulty of restoring or establishing certain wetlands/aquatic resources (33 CFR 332.3 (f)).

The Federal Mitigation Rule 2008 also states that "difficult-to-replace" wetlands/aquatic resources include bogs and forested wetlands (33 CFR 323.3(e)(3) and Preamble, page 19633). The majority of wetlands that would be ~~affected~~ impacted by the NorthMet Project Proposed Action would be "difficult-to-replace" (coniferous bog, open bog, coniferous swamp, and hardwood swamp) (USACE 2013).

USACE St. Paul District Policy (2009) states that compensation ratios can be raised on a case-by-case basis if the ~~affected~~ impacted wetland/aquatic resource provides rare or exceptional functions, including plant communities that rate "exceptional" using MnRAM, or have a high rating using a Floristic Quality Assessment. Most of the wetlands that would be ~~affected~~ impacted by the NorthMet Project Proposed Action would be of pre-European settlement condition and rate at the highest Floristic Quality Assessment levels for those plant communities in Minnesota. MnRAM vegetative diversity/integrity ratings would be "exceptional" for these pre-European settlement condition wetlands. Therefore, per the USACE St. Paul District Policy 2009 ~~policy~~, the District Engineer may determine that a higher compensation ratio would be required to offset losses of wetlands that would be difficult to replace and/or provide an exceptional level of functions.

USACE St. Paul District Policy 2009 states a base compensation ratio of 1.5:1 (1.5 credits of compensatory mitigation for every 1 acre of wetland loss), and a minimum of 1:1, with a provision for a case-by-case determination of higher ratios to account for factors including difficult-to-replace, rare, and/or exceptional wetlands/aquatic resources. For low- to moderate-quality wetlands, the 1.5:1 base ratio would apply in accordance with District Policy. For ~~effects~~ impacts on high-quality wetlands, the USACE may require additional compensation in accordance with District Policy. The 1.5:1 ratio can be reduced by qualifying for the following incentives, but can be no less than a minimum 1:1 ratio:

- In-place incentive: the project-specific mitigation site is located on site or within the same 8-digit HUC watershed as the authorized wetland ~~effects~~ impacts or bank credits are purchased within the same bank service area—reduce ratio by 0.25.
- In-kind incentive: the mitigation wetlands are of the same type (same wetland plant community) as the wetlands authorized to be ~~affected~~impacted—reduce ratio by 0.25.
- In-advance incentive: 1) a project-specific mitigation site must have wetland hydrology and initial hydrophytic vegetation established at least one full growing season in advance of the authorized wetland ~~effects~~ impacts provided initial performance standards are met, or 2) USACE-approved bank credits are purchased—reduce ratio by 0.25.

If none of these incentives are met, the minimum mitigation ratio required is 1.5:1. If one of the three incentives is met, the minimum required mitigation ratio is 1.25:1; if two or three are met, the ratio is 1:1. According to USACE St. Paul District's compensatory wetland mitigation policy (USACE 2009), requirements for mitigation can exceed the 1.5:1 mitigation ratio if the ~~affected~~ impacted wetlands provide rare or exceptional functions.

District guidance on compensatory mitigation emphasizes the consideration of a functional approach to offset proposed project ~~effects~~impacts. While bogs and forested wetlands are characterized as difficult-to-replace, the proposed compensation sites for the NorthMet Project Proposed Action (discussed below) would be likely to achieve in-kind compensation to offset

functional losses. The proposed mitigation sites were selected based on availability and the high likelihood of meeting performance criteria.

~~The replacement of lost wetland functions and values via compensatory mitigation is considered of upmost importance; therefore, t~~~~The~~T proposed wetland restoration and enhancement performance criteria place a strong emphasis on ensuring that the proposed mitigation strategy provides for the adequate replacement of lost functions. For purposes of compensatory mitigation, the focus is on functions. The Federal Mitigation Rule 2008 specifically eliminated use of the term "values." An abbreviated MnRAM functional assessment, which was agreed upon by the USACE, was utilized to assess wetland functions for the Mine Site, Transportation and Utility Corridor, and Plant Site. Both the USACE and WCA require functions to be replaced; however, both agencies use a set of defined ratio requirements to determine the number of acres required to replace functions lost as there is currently no suitable quantitative functional assessment method in Minnesota. Based on the findings and where impacts occur (e.g., types of wetlands), the mitigation ratios and credits have been increased to take into account the functions lost due to the NorthMet Project Proposed Action. For example, additional compensatory mitigation (i.e. higher replacement ratios) is proposed to offset loss of bog wetlands, a difficult-to-replace wetland type. All of the wetland mitigation proposed would be restoration with a minimal component of wetland preservation; no creation of wetlands would be part of the off-site mitigation.

The USACE St. Paul District has not made a final determination of the compensation ratios that would be required. A decision on whether proposed compensation would qualify for the 0.25 incentive for in-advance requires additional information including: 1) development of performance standards that would specify the hydrology and initial vegetation to be established, and 2) number of growing seasons that wetland compensation sites would be established in advance of authorized impacts. Final determination of compensation ratios and use of incentives will be determined during permitting.

The compensatory mitigation ratios proposed in the FEIS~~SDEIS~~ for the NorthMet Project Proposed Action are based on recommended USACE St. Paul District guidance. They assume successful outcomes for the proposed compensatory mitigation sites. Base compensation ratios, as presented in the FEIS, ~~could be increased to 2:1~~ for ~~effects~~ impacts on high-quality, difficult-to-replace bog and forested wetlands have been increased to 2:1 (USACE 2013). For ~~effects~~ impacts on low- and moderate-quality wetlands, a base ratio of 1.5:1 would be applied (USACE 2013). In-kind, in-place, and in-advance incentives to reduce the recommended base ratios would be considered at the time of permitting. USACE St. Paul District guidance on recommended compensation ratios takes these incentives into account. The final decision on compensatory mitigation ratios and the use of incentives will be determined at the time of the CWA Section 404 permit decision based on current District guidance.

USACE compensatory wetland mitigation is regulated by 33 CFR 332.3(n), which describes the use of financial assurances. The District Engineer may determine that financial assurances are unnecessary for a compensatory mitigation project if alternate mechanisms are available to ensure a high level of confidence that the mitigation would be provided and maintained. ~~In the state permitting process for WCA, *Minnesota Rules*, part 8420.05522 subp 990552, sets forth replacement standards and requires financial assurances to ensure successful wetland replacement.~~approval authority Additionally, the MDNR has the authority through the Permit to Mine process to require a performance bond or other instrument that meets criteria in rule as

~~means to ensure compliance with *Minnesota Rules,* part 6130, which includes successful completion of reclamation and closure activities.~~

The CWA Section 404 permit and the Permit to Mine (see below) both have financial assurance mechanisms to ensure successful completion of the 1) compensatory mitigation (in the case of the CWA Section 404) and 2) NorthMet Project Proposed Action (in the case of the Permit to Mine). Financial assurance can be a condition of a permit under CWA Section 404, and the MDNR has authority to require a performance bond or other instrument that meets criteria in rule for compliance with the conditions of the Permit to Mine. Section 3.2.2.4 provides a discussion of the financial assurance for the NorthMet Project Proposed Action.

The USACE generally requires compensatory mitigation for adverse ~~effects~~ impacts to aquatic resources under 33 CFR 332.3(n). This regulation establishes standards and criteria for the general compensatory mitigation requirements of the Section 404 permit. Specifically, 33 CFR 332.3(n)(1) addresses financial assurance stating:

> The district engineer shall require sufficient financial assurances to ensure a high level of confidence that the compensatory mitigation project will be successfully completed, in accordance with applicable performance standards.

Compensatory wetland mitigation for the NorthMet Project Proposed Action is expected to be approved and constructed in advance of any authorized wetland ~~effects~~ impacts (under the Section 404 permit) and, therefore, ~~would~~ may not require financial assurance for direct impacts. However, the USACE ~~can~~ could consider financial assurance for potential indirect wetland effects and monitoring when additional detail has been provided. Financial assurance requirements by the USACE would be determined during permitting.

State Mitigation Ratios and Financial Assurance

Minnesota Rules, part 7050.0186, requires compensatory mitigation to be sufficient to ensure replacement of the diminished or lost designated uses of the wetland that was physically altered. To the extent prudent and feasible, the same types of wetlands ~~affected~~ impacted are to be replaced in the same watershed, before or concurrent with the actual alteration of the wetland. In addition, the WCA states that for wetlands in counties where 80 percent or more of pre-settlement wetlands exist, including St. Louis County, minimum replacement ratio requirements are as determined by mitigation location and type (see Table 5.2.3-17). Based on the WCA wetland replacement standards (*Minnesota Rules* 8420.0522, Subpart 4), the ~~mitigation credits will qualify at a ratio of~~ required replacement ratio ~~will~~would be either 1:1 or 1.5:1. For those wetlands that would be replaced in the watershed with the same wetland type, the base replacement ratio that would likely be required is 1:1, and for those wetlands that would be replaced outside of the watershed, the ratio would be increased to 1.5:1. The actual replacement ratios required in permitting may be more than the minimums shown in Table 5.2.3-17, subject to the evaluation of wetland functions ~~and values~~.

Table 5.2.3-17 Summary of Wetland Mitigation Ratios

Regulation	Location of ~~Effect~~Impacts	Replacement	Minimum Replacement Ratio
Minnesota Administrative Rules			

Regulation	Location of ~~Effect~~Impacts	Replacement	Minimum Replacement Ratio
	Minimum Replacement Ratios: Wetland Banking		
	>80% area or agricultural land	Outside bank service area	1.5:1
		Within bank service area	1:1
	~~<50% area, 50-80% area, and non-agricultural land~~	~~Outside bank service area~~	~~2.5:1~~
		~~Within bank service area~~	~~2:1~~
	Minimum Replacement Ratios: Project-Specific		
	>80% area or agricultural land	Outside major watershed or out-of-kind	1.5:1
		Within major watershed and in-kind	1:1
	~~<50% area, 50-80% area, and non-agricultural land~~	~~Outside major watershed or out-of-kind~~	~~2.5:1~~
		~~Within major watershed and in-kind~~	~~2:1~~
USACE			
	>80% area	Not in-place, in-kind nor in-advance	1.5:1
		In-place, in-kind and in-advance	1:1
	~~<80% area~~	~~Not in-place, in-kind nor in-advance~~	~~2.5:1~~
		~~In-place, in-kind and in-advance~~	~~2:1~~

Sources: Wetland Conservation Act; USACE 2009.

Minnesota Rules 8420.0522 outlines the replacement standards for wetlands as regulated under WCA. *Minnesota Rules* 8420.0522, subparts 9(A) and (B) discuss financial assurance requirements for compensatory wetland mitigation stating:

> (A) For wetland replacement that is not in advance, a financial assurance acceptable to the local government unit must be submitted to, and approved by, the local government unit to ensure successful replacement. The local government unit may waive this requirement if it determines the financial assurance is not necessary to ensure successful replacement. The local government unit may incorporate this requirement into any financial assurance required by the local government unit for other aspects of the project.
> (B) The financial assurance may be used to cover costs of actions necessary to bring the project into compliance with the approved replacement plan specifications and monitoring requirements.

Financial assurance could be waived by the approval authority if it is determined that financial assurance is not necessary to ensure wetland replacement. Additionally, the MDNR has the authority through the Permit to Mine process to require a performance bond or other instrument that meets criteria in rule as means to ensure compliance with *Minnesota Rules*, part 6130, which includes successful completion of reclamation and closure activities.

The financial assurance requirements would be part of the WCA permitting process for the NorthMet Project Proposed Action. Wetland replacement for the NorthMet Project Proposed Action is ~~expected~~ anticipated to be approved and constructed in advance of any authorized wetland ~~effects~~impacts (under WCA approval) and, therefore, would not require financial assurance.

Section 401 of the CWA requires the MPCA to certify that all projects that receive a federal license or permit are in compliance with state and federal water quality guidelines. Therefore, as part of their review, the MPCA conducts a separate review for compliance with water quality standards and policies and guidelines, which includes mitigation for wetland ~~effects~~ impacts and

approval of the wetland replacement ratios. This review process must be completed before the DA permit pursuant to Section 404 of the CWA can be issued.

Summary of Mitigation Requirements

PolyMet would ultimately need to satisfy both the federal and state mitigation requirements. The number of mitigation credits to be earned by replacement wetlands would be determined during permitting by the appropriate agencies reviewing the wetland mitigation plan. The NorthMet Project Proposed Action is estimated to directly ~~affect~~ impact 9~~12.5~~13.8 acres. Depending on the location, type, and timing of compensatory mitigation, the minimum required amount of replacement wetlands for direct ~~effects~~impacts, based upon USEPA recommendations, could potentially range from 9~~12.5~~13.8 acres up to 1,82~~5.0~~7.6 acres (i.e., 1:1 up to 2:1 compensation ratios).

The USACE has concluded that the mitigation sites selected and the wetland credits generated at the three mitigation sites would be acceptable for use in compensating for direct wetland losses. The USACE has not made a final decision on the mitigation ratios that would be required to compensate for direct wetland impacts; if fully successful, it is likely these three mitigation sites would generate sufficient credits to compensate for the 940.7 acres of wetlands directly impacted. In the event that not all of the credits generated by these sites are utilized to compensate for direct wetland impacts, any excess credits could be used to compensate for indirect losses (USACE 2015a). The proposed mitigation presented below currently shows that PolyMet could have an excess of mitigation credits from the three mitigation sites if the mitigation sites are successful and meet the performance standards. However, it is understood that mitigation sites sometimes are not fully successful; contingency plans (discussed below) would be developed for the NorthMet Project Proposed Action and approved during permitting. The USACE encourages the development of mitigation for foreseeable indirect effects and the mitigation plan currently is achieving this.

Financial assurance may not~~be required~~ necessary for the direct wetland impacts; however, wetland mitigation is expected to be approved and constructed in advance of any authorized wetland impacts. However, the USACE could consider financial assurance for potential indirect wetland effects and monitoring. Both the USACE and state would require consideration of financial assurance during the permitting process. ~~consideration of ,~~

Wetland mitigation for potential indirect wetland effects would be determined by the agencies during permitting. If the NorthMet Project Proposed Action were to be permitted and constructed, wetland monitoring would be conducted to determine if the NorthMet Project Proposed Action ~~would~~ caused future indirect wetland effects. Wetlands hydrology and vegetation would be monitored, and additional monitoring locations may be considered during permitting. A component of the monitoring plan would be based on those wetlands that have a high likelihood of indirect effects as a result of groundwater drawdown. If the monitoring determined that indirect wetland effects had occurred, additional compensation may be required if determined necessary based on the monitoring results. In the event that the wetland monitoring identified additional indirect effects, permit conditions would likely include a plan for~~appropriate measures (i.e.,~~ adaptive management practices to ~~) would~~ be implemented, such as expanded monitoring and ~~,~~ hydrologic controls. ~~or a~~Additionally, compensatory mitigation may be required if additional impacts are identified during annual reporting. ~~Permit conditions would~~

~~likely include an adaptive management plan to account for any additional effects that may be identified in the annual monitoring and reporting.~~

Wetland Mitigation Study Limits

The NorthMet Project area lies in St. Louis County in the St. Louis River Watershed (#3) within the Lake Superior basin (wetland mitigation Bank Service Area #1). Locations for wetland mitigation projects were evaluated in the following priority order:

- on-site;
- off-site in the St. Louis River Watershed (same 8-digit HUC)~~and adjacent watersheds tributary to Lake Superior~~;
- off-site in the Great Lakes Basin (same 4-digit HUC)~~watersheds adjacent to the St. Louis River Watershed~~; and
- off-site in an ~~watersheds neighboring~~ adjacent 4-digit HUC, selecting an 8-digit HUC as close as possible to the impacted site~~watersheds~~.

Each of these potential locations areas is described below.

On-site Mitigation

In accordance with the USACE's St. Paul District Compensatory Wetland Mitigation Policy (USACE 2009) and state guidelines, the potential for creating wetlands on-site was considered first. The Wetland Management Plan (PolyMet 2015~~3~~ch) ~~has~~ identified the potential for ~~following~~ on-site ~~mitigation~~restoration during reclamation. On-site wetland ~~mitigation~~ restoration (101.8 acres) is planned in the following areas: temporary Category 2/3 Stockpile, Overburden Storage and Laydown Area, some haul roads and adjacent ditches, and WWTF ponds and process water ponds. Establishment of on-site wetlands is expected to occur during reclamation. Of the 101.8 acres of planned on-site wetland ~~mitigation~~restoration, 72 acres of wetlands may be created at the temporary mine stockpile areas after removal of the Category 2/3 Stockpile and the Overburden Storage and Laydown Area. The remaining acres of wetland ~~mitigation~~ restoration would be within the other above mentioned Project areas. ~~Because it may not be feasible to construct wetlands on the entire footprint of these temporary areas, it has been assumed that only the area equivalent to the directly affected wetlands within the footprints would be viable for wetland mitigation.~~ Design of wetland ~~mitigation~~ restoration areas would be further evaluated in the detailed reclamation design and would include the preservation of upland buffer around the perimeter of the wetland ~~mitigation~~ restoration areas. The establishment of the estimated 101.8 acres of on-site wetland ~~mitigation~~ restoration is not included in the mitigation credits. The generation of wetland credits in these areas has the potential to be used on a contingency basis, but compensatory credit will not be considered ~~up front~~at this timefor a variety of reasons including the fact that any restoration efforts will not occur for ~~-~~many years~~-~~.

Off-site Mitigation

The initial wetland mitigation study scope focused on the areas containing greater than 80 percent of their historic wetland resources as defined in the WCA. This area was selected as the initial study area to comprehensively cover the priority mitigation areas, with the understanding that suitable opportunities may not be available within each priority area.

Available wetland mitigation banking credits that were available for purchase by PolyMet were evaluated in portions of bank service areas 1 through 6 and found to be insufficient to satisfy the compensatory mitigation requirements for the NorthMet Project Proposed Action. Subsequently, a GIS analysis was performed to identify potential wetland mitigation sites within the defined study area. The primary goal of the analysis was to identify large, potentially drained wetlands located primarily on private or tax-forfeit land within the study area to provide preliminary data for more detailed ground investigations to proceed. To achieve the goal of the mitigation plan, which is to replace lost wetland functions ~~and values~~ using compensatory wetland types in-kind to the degree practicable, areas where drained wetlands could be restored were preferable over areas where wetlands could be created (Barr 2008m). Other siting criteria used in the GIS analysis included potential wetland enhancement areas, potential wetland preservation areas, and potential wetland creation areas (Barr 2008m). Sites were identified by overlaying and evaluating numerous existing spatial data sources to locate those sites with the greatest mitigation potential. Some of the data sources utilized included the following:

- geomorphology/soil types (Loesch 1997);
- land ownership (separated by county/state/federal and private ownership) (MLMIC 1983);
- land slope/Digital Elevation Model (MLMIC 1999);
- streams/ditches (MDNR 1980);
- major watersheds; and
- land cover (Loesch 1998).

The analysis was conducted by establishing specific filtering criteria to identify potential wetland mitigation sites. The general filtering criteria included the following:

- land slopes of less than or equal to 1 percent slope;
- ~~mapped~~ areas mapped as peat or lacustrine geomorphology;
- private or county tax-forfeit property;
- areas within 1.1 miles of a ditch; and
- areas meeting all of the above criteria with at least 100 contiguous acres.

The analysis was limited to sites with more than 100 acres of wetland mitigation potential due to the anticipated difficulties in planning numerous, small wetland mitigation projects, and the desire to identify opportunities that were feasible. In addition, the NorthMet Project Proposed Action represented an opportunity to restore large wetland systems and provide greater public and ecological benefit that are typically not available with smaller projects.

This GIS analysis resulted in the development of a polygon data layer, which contained nearly 900 areas with potential for mitigation in the study area. This analysis resulted in several findings.

First, a large proportion of the study area was in state and federal ownership. Discussions with the various state and federal entities regarding wetland mitigation on their respective properties resulted in the following conclusions:

- The USFS was unable to provide assurances that they would be able to protect restored wetlands on federal lands in perpetuity as required by wetland regulations.
- The State of Minnesota provided general criteria for restoring wetlands on state lands. The criteria required either a justification for how revenue production (i.e., peat mining, forest harvest) would not be affected or provide land in exchange that had a comparable value. PolyMet determined that these were not acceptable criteria and the state provided no certainty that the NorthMet Project Proposed Action would be viable if PolyMet expended 1 to 2 years of effort to meet the imposed criteria. This conclusion was supported in part by an effort to restore wetlands on Site 8362, a partially state-owned site, as discussed below.
- The Board of Water and Soil Resources has oversight regarding the administration of the Minnesota WCA. The Board of Water and Soil Resources provides guidance and interpretation of the WCA rules and has the most extensive experience with application of the rules. The Board of Water and Soil Resources' experience with wetland restoration on tribal lands found that impressing permanent conservation easements granted to the state was not possible to protect the restored wetlands.
- PolyMet had a signed agreement with St. Louis County near Floodwood to restore wetlands as mitigation (see discussion on Site 8362 below) for the NorthMet Project Proposed Action. The agreement was nullified by the state courts. In addition, legal proceedings through the state legislature and state court would have been required for ditch abandonment and for placement of a conservation easement on the land.

Therefore, it was determined that, because of these uncertainties and risks, mitigation on state and federal lands represented a minimal potential for a private enterprise to conduct compensatory wetland mitigation on these lands.

Second, many of the wetland systems within the study area have not been affected by historic drainage or other significant alteration. In areas lacking significant alterations, wetland preservation and establishment of upland buffers constitute the primary methods to generate wetland compensation credits within the study area. Wetlands that meet the criteria for wetland restoration credits include completely drained wetlands, partially drained wetlands, and wetlands with at least a 20-year history of agricultural production (Barr 2008m).

Third, much of the study area was characterized by surface geology that is not indicative of large wetland systems prone to easy drainage. The majority of the Arrowhead region, including Cook, Lake, and much of St. Louis counties, is mapped with surface geology typified by steep, igneous bedrock terrains; rolling till plains; and rolling to undulating areas of supraglacial drift (Loesch 1997). These geomorphological associations are also typically associated with steeper land slopes containing few drained or sufficiently altered wetlands.

Opportunities exist for accomplishing the preferred method of wetland compensation—restoration—within the St. Louis River Watershed and northeastern Minnesota in general. Tens of thousands of acres of peatlands are adversely affected by ditch systems. Specific to the St. Louis River Watershed, hundreds of acres of ditched, hydric soils in agricultural use exist in the central portion of the watershed. A determination by the USACE as to the practicality of wetland restoration within one or more of these sites has not been completed.

St. Louis River Watershed (Same 8-digit HUC)

Approximately 101 potential wetland mitigation areas were identified within the St. Louis River Watershed and other watersheds tributary to Lake Superior. The specific areas identified as having potential for wetland restoration were evaluated in more detail by reviewing NWI maps, plat maps, recent aerial photographs, and USGS topography to find the sites with the highest potential.

The sites with the highest potential were further evaluated by conducting site visits and meetings with various regulatory agencies. The majority of these potential mitigation sites, however, were eliminated from further consideration due to issues that included: lack of wetland drainage or altered land uses that would qualify as wetland restoration or enhancement (e.g., unaltered sites can qualify for regulatory compensation credits such as wetland preservation and upland buffers); infeasibility of planning numerous small projects; potential flooding of private property, roads, or other infrastructure; upstream ditch drainage through the potential wetland restoration areas that would have to be maintained; potential soil contamination; regulatory applicability; complex land ownership; existing peat mining operations; and legal considerations.

For purposes of the CWA regulatory program, the term *highest potential* is not the applicable standard for evaluating compensatory mitigation. Rather, *practicable* is the standard used in conjunction with the fundamental goal of compensatory mitigation: replace lost wetland functions, in-kind and in-place, to the extent practicable. Potential compensation sites are not limited to those that are least difficult and/or least expensive. Sites that have some greater difficulty and/or cost may be practicable, particularly if they are the only sites that would meet the fundamental goal of compensatory mitigation.

The area around Meadowlands and Floodwood appeared to have the most suitable characteristics. Two contiguous areas in this region, covering approximately 270 square miles, were mapped as level peat. The one site found to be initially feasible was designated as Site 8362. Site 8362 was located within the same watershed as the NorthMet Project area, had the greatest potential for wetland restoration with limited peripheral issues, and contained the potential to restore bog wetlands similar to those proposed for effect. Thus, Site 8362 was initially selected for further study and PolyMet signed an agreement with St. Louis County. Approximately 640 acres of the site are owned by the State of Minnesota with the remainder designated as tax-forfeit land. Further pursuit of wetland restoration activities at Site 8362 was halted for a number of reasons that rendered the site impracticable, including the following:

- The district court nullified PolyMet's agreement with St. Louis County in April 2007, thereby not allowing any further study of the site.
- There was a lack of local support, and there was, in fact, broad opposition from local residents.
- Extensive hydrologic monitoring and evaluation was required to document the degree of drainage at the site to support the proposed mitigation credits. This would have required long-term monitoring to adequately demonstrate the drainage and there was uncertainty regarding the outcome of such monitoring. Such monitoring activities were no longer allowed after April 2007 due to the district court action.
- Preservation credits would only be allowed where there was a demonstrable threat that could be eliminated (i.e., peat mining, tree-topping, or all-terrain vehicle activity). There are only about 400 acres of documented minable peat and the County had indicated they were

unlikely to agree to limit tree-topping activities. Therefore, the ability to show a demonstrable threat that would meet regulatory criteria appeared unlikely.

- Even if the agreement with the county was reestablished, that agreement would have required ditch-abandonment proceedings in district court with public hearings that would have likely been opposed by local residents.
- The agreement with the County (if it were to be reinstated) would have also required receiving legislative authorization to place a permanent conservation easement over the restoration area. The likelihood of that was uncertain.

One additional wetland restoration area has been further identified since the DEIS within the NorthMet Project area watershed. The Zim Sod (Zim) wetland mitigation site is located in St. Louis County in the St. Louis River major watershed (#3), within the Lake Superior basin (bank service area #1) (see Figure 5.2.3-30).

Great Lakes Basin (Same 4-digit HUC) ~~***Watersheds Adjacent to the St. Louis River Watershed***~~

With Site 8362 no longer a feasible mitigation option, pursuit of the high-priority sites identified in watersheds adjacent to the St. Louis River Watershed was initiated along with the continued search for existing bank credits, wetland banks in various stages of planning, and various other potential wetland mitigation opportunities located in central and northwestern parts of Minnesota.

Fifteen sites were determined to have high potential for wetland mitigation in watersheds located adjacent to the St. Louis River Watershed. Of these, 10 sites were evaluated in the Mississippi River-Grand Rapids Watershed, three sites were evaluated in the Kettle River Watershed, and two sites were evaluated in the Nemadji River Watershed. After further study, these sites were eliminated from further consideration due to issues that included: lack of wetland drainage or altered land uses that would fit the regulatory requirements for restoration credit; potential flooding of roads or other infrastructure; upstream ditch drainage through the wetland that would have to be maintained; complex land ownership; existing peat mining operations; and legal considerations.

Adjacent 4-digit HUC, Selecting an 8-digit HUC as Close as Possible to the Impacted Site ~~***Watersheds Neighboring Adjacent Watersheds***~~

Ten potential wetland mitigation sites, initially determined to have some potential, were located in watersheds neighboring the watersheds adjacent to the St. Louis River. These sites were evaluated to determine the relative potential for mitigation, the level of risk and uncertainty, and the likely costs. These sites were primarily located in Aitkin County.

Eight of these 10 sites were eliminated from further consideration due to issues that included unwilling landowners, significant private properties that would be hydrologically affected by wetland restoration, insufficient agricultural history, insufficient wetland drainage to qualify for restoration credit, considerable existing upstream drainage through the site, or active pursuit of the properties by others. Two priority properties were identified with willing landowners that had the potential to accomplish compensatory wetland mitigation for nearly the entire NorthMet Project area. These sites are located in watersheds neighboring those adjacent to the St. Louis River and outside the 1854 Ceded Territory. These two sites included the Aitkin mitigation site

(Aitkin) and the Hinckley mitigation site (Hinckley). The Aitkin and Hinckley sites are located within the Mississippi River Basin (4-digit HUC) and 8-digit HUC watersheds of Elk-Nokasippi #10 and Snake River #36, respectively (see Figure 5.2.3-30). The Aitkin wetland mitigation site is located in Aitkin County in bank service area #5 and the Hinckley site is located in Pine County in bank service area #6 (see Figure 5.2.3-30). USACE St. Paul wetland compensatory mitigation replacement ratios are based on three factors: in-place versus out-of-place, in-kind versus out-of-kind, and in-advance versus not in-advance (see Table 5.2.3-17). As previously stated, the USACE St. Paul District and the state have ~~has~~ not made a final determination of the compensation ratios that would be required for the NorthMet Project Proposed Action. Base compensation ratios for USACE would be either 2:1 or 1.5:1 and for the state 1.5:1 or 1:1 depending on the location, quality of the wetland, wetland type, and timeframe of the compensation. The final decision on compensatory mitigation ratios will be determined at the time permitting~~of the CWA Section 404 permit decision based on current District guidance~~.

Off-site Wetland Restoration Projects

The off-site wetland restoration projects, as defined in the Wetland Management Plan (PolyMet ~~2013h~~2015c), that would provide required mitigation for the NorthMet Project Proposed Action wetland ~~effects~~ impacts include Hinckley, Aitkin, and the Zim wetland mitigation sites (see Figure 5.2.3-30). As previously noted, the Zim site is located within the NorthMet Project area 8-digit HUC watershed, whereas Aitkin and Hinckley are located outside the 8-digit HUC watershed area. The mitigation would be considered in advance if the ~~The~~ initial phases of restoration on all of the proposed off-site wetland mitigation sites would be completed at least one full growing season in advance of the authorized wetland ~~effects~~ impacts provided initial performance standards are met for which the mitigation would compensate.

The proposed mitigation is expected to compensate for all the direct wetland ~~effects~~impacts, as well as the indirect fragmentation effects—a total of ~~939.4~~940.7 acres (see Tables 5.2.3-19 and 5.2.3-20). The majority of the credits would be in-kind mitigation and nearly one-~~half~~ third of the credits would be from within the NorthMet Project area watershed (see Tables 5.23-18, 5.2.3-19, 5.2.3-20). Based on PolyMet's current mitigation proposal and a~~A~~ssuming the mitigation efforts are fully successful and target communities are established, 83 percent of the impacts to coniferous bogs would be mitigated by in-kind and in-place credits, or 439.9 coniferous bog credits; the remaining 17 percent would be replaced out-of-kind. Out-of-kind credits would be used to mitigate for impacts on wet meadow, shallow marsh, deep marsh, open bog, and coniferous bog communities; these would not be replaced in-kind because of hydrological and ecological constraints at the proposed mitigation sites. Forty seven percent of the wetland impacts are currently proposed to be replaced in-kind, in-place, and before the impacts occur on-site. An additional 29 percent of the proposed impacts are proposed to be replaced in-kind and before the impacts occur on-site. Most of the additional mitigation credits that are proposed outside of the watershed would fulfill mitigation requirements above the minimum 1:1 ratio.

~~Out-of-kind credits would be used to mitigate for effects on 39.9 acres of deep marsh communities that would not be fully mitigated in-kind at the proposed mitigation sites (PolyMet 2013q). The Section 404 permit application provides more details on how the mitigation credits would be used.~~

Mitigation credits assumed for calculations include 100 percent credit for restoration of drained/farmed wetlands ~~and created ponds~~, 75 percent credit for creation of on-site wetlands, 50

percent credit for partially drained wetlands and ditches, 25 percent credit for upland buffer, and 12.5 percent credit for preservation. The final mitigation credits required to offset the ~~effects~~ impacts of the proposed NorthMet Project Proposed Action would be determined by the agencies during wetland permitting.

Aitkin Site

The Aitkin site is currently an active sod farm that has been drained by ditches and subsurface drain tiles. The overall objective of the restoration plan is to restore the hydrology by removal of the internal drainage system and the construction of outlets that regulate the required hydrological conditions (Barr 2008m). The site has also been used for sod, wheat, soybeans, sunflowers, and wild rice production. The 1,070-acre site is located north of the city of Aitkin, Minnesota, in Aitkin County. The site is in the Elk-Nokasippi major watershed within bank service area #5, adjacent to bank service area #1 where the NorthMet Project area would be located.

The site is located outside of the NorthMet Project area watershed. The proposed wetland mitigation area includes 8~~10.2~~08.3 acres of wetland restoration and ~~123.1~~83.2 acres of upland buffer preservation. Restoration methods on the site are designed to restore the following wetland types: ~~(Type 2) fresh wet meadow, (Type 2) sedge meadow,~~ (Type 3) (shallow marsh), ~~(Type 4) deep marsh,~~ (Type 6) (shrub-carr), ~~(Type 6) alder thicket,~~ (Type 7) (hardwood swamp), and (Type 7) (coniferous swamp)~~, and (Type 8) coniferous and open bog~~.

Hydrology monitoring at the Aitkin site began in 2012, as well as at a reference wetland site, to characterize the pre-restoration hydrology, and continued in 2013 and 2014 (PolyMet 2015c). Based on the 2 years of monitoring data at the Aitkin Site, monitoring indicates that the majority of the site no longer has wetland hydrology. Results of 2014 monitoring would be submitted to the appropriate agencies USACE and the MDNR in 2015. Concurrence of the monitoring results would be conducted by permitting agencies during the permitting process (PolyMet 2015c).The state and federal agencies have not yet made a determination on the drainage status of the mitigation site (i.e., drained, partially drained, etc.); this determination would be made during permitting, including credit ratios.

The minimum replacement ratio that would be allowed by the USACE is 1:1 (USACE 2009) for those wetlands that would be replaced with the same wetland type, and at least one full growing season in advance of the authorized wetland ~~effects~~ impacts provided initial performance standards are met; however, base compensation ratios ~~could be increased to 2:1~~ for ~~effects~~ impacts on high-quality, difficult-to-replace bog and forested wetlands would be increased to 2:1 (USACE 2013). For ~~effects~~ impacts on low- and moderate-quality wetlands, a base ratio of 1.5:1 would be applied (USACE 2013). In-kind, in-place, and in-advance incentives to reduce the recommended base ratios would be considered at the time of permitting (see Tables 5.2.3-18 and 5.2.3-19). Compensation proposed at the Aitkin Site would be expected to meet in-kind compensation, resulting in a compensation ratio for high-quality wetland ~~effects~~ impacts of 1.75:1, and if in advance, the ratio would be reduced to 1.5:1. For low- to moderate-quality wetlands, the recommended base ratio of 1.5:1 would be required and could be reduced to 1.25:1 if in-kind and 1:1 if also in-advance.

Under the Minnesota WCA, the replacement ratio that would likely be ~~allowed~~ required is 1.5:1, because the Aitkin Site ~~for those~~ wetlands ~~that~~ are ~~replaced with the same wetland type and~~ out of the NorthMet Project area watershed (see Tables 5.2.3-18 and 5.2.3-20).

The site-specific mitigation design proposed by PolyMet includes the following methods of restoration to receive wetland mitigation credits, which will be approved during permitting:

- restoration of effectively drained wetland (restoration via reestablishment) on ~~810.2~~758.3 acres for 100 percent mitigation credit or 758.3~~810.2~~ credits;
- hydrologic restoration of 50.1 acres of partially drained wetland (restoration via rehabilitation) to receive 50 percent credit or 25.0 credits; and
- restoration of native vegetation on ~~123.1~~83.2 acres of uplands and filled ditches, for 2~~3~~0.8 credits based on the 25 percent credit calculation for upland buffer.

The vegetation and hydrology would likely be restored to the site over a 1- to 2-year construction period, followed by up~~10~~ to 20 years of management, or more, if warranted. The restoration work is expected to begin on the site after permit approval such that the initial phases of the restoration would be completed more than one full growing season before the ~~effects~~ impacts from the NorthMet Project Proposed Action would occur (PolyMet 2013q). Performance standards have been developed for the mitigation site to guide the restoration activities and to monitor whether vegetation and hydrology are meeting the design goals. To protect the site, a~~A~~ permanent conservation easement or deed recording ~~or deed restriction~~ would be prepared and recorded at approval of permit or prior to impact, as required by the permitting agency~~to protect the site within 1 year after initializing the restoration activities.~~ The wetland restoration area would be monitored for up ~~10~~ to 20 years beginning in the first full growing season after completing hydrologic restoration and ending upon certification by the USACE and MDNR that the wetlands have met performance standards (~~PolyMet 2013h;~~ PolyMet 2013q; PolyMet 2015c).

The objective is to restore hydrology within the site by removing the internal drainage system and constructing outlets to establish specific hydrologic conditions that would meet the goals and performance standards established for the site and approved by the appropriate agencies. The hydrology will be restored utilizing broad, rock-lined weirs, and eliminating culverts with the exception of the culverts in a couple of locations. Once hydrology restoration has been achieved, an adaptive management program is proposed to guide development of the restored wetlands to achieve the targeted conditions. The vegetative restoration of the herbaceous layer in each wetland community would be conducted to promote the establishment of characteristic native species that are present in the seed bank or that may be transported to the area from adjacent wetlands. The goal of the restoration is to provide a setting and conditions in which the restoration areas would be restored to naturally self-sustaining and functioning wetlands to the extent feasible. The proposed wetland communities have been planned in areas that appear to match the natural hydrologic characteristics of each community type. However, during the restoration process, it is expected that the defined areas and wetland communities may change to some degree and the plan would allow for adaptation to the conditions. The overall plan for the Aitkin Site includes the following components: general site preparation, natural regeneration in all proposed communities, seeding/planting of shallow marsh and shrub-carr communities, planting hardwood swamp community, seeding/planting of coniferous swamp community, and upland area establishment. ~~The vegetative restoration of each non-forested, non-bog community would be conducted to promote the establishment of characteristic native species that are present~~

~~in the seed bank or that may be transported to the area from adjacent wetlands.~~ General site preparation would be prior to or concurrent with hydrological restoration activities. Existing, non-native, and invasive vegetation would be removed through mechanical means or herbicide application. Diverse, native wetland vegetation is expected to develop in the restoration wetlands from the existing seed bank and from the wetland vegetation that surrounds the wetland restoration site through vegetative propagation and seed dispersal mechanisms. At the end of the second growing season these areas would be assessed to determine if additional seeding is required. These areas include ~~sedge and wet meadows,~~ shallow ~~and deep~~ marsh, emergent fringes, and shrub-carr~~, and alder thicket~~.

Hardwood swamp communities would require planting of trees in the spring of the second or third year after construction, depending on the success of herbaceous species establishment, the presence of invasive species, and the stability of the hydrology. ~~and~~ Coniferous swamp communities would be established initially by direct ~~along with open and coniferous bogs would require herbaceous and woody species~~ seeding tamarack in the spring. ~~as well as some woody seedling installation. Open and coniferous bogs would also require the installation of a sphagnum moss layer. The Mine Site may provide up to half the donor soil material (i.e., sphagnum) for this mitigation site.~~

Vegetation in the existing upland areas would be managed to promote natural succession of the existing plant communities. The primary maintenance activity would be control of non-native invasive species and seeding to develop diverse, native communities. ~~such as buckthorn, honeysuckle, and garlic mustard.~~

Hinckley Site

The Hinckley site currently has about 375 acres under agricultural production and has been drained by ditches and sub-surface drain tiles. This 511-acre site is located southwest of the city of Hinckley, Minnesota at the intersection of Sod Road and Highway 107. The mitigation site is located in Pine County in the Snake River major watershed (#36) within bank service area #6, adjacent to bank service area #1 where the NorthMet Project area is located. The overall objective of the Hinckley restoration plan is to restore the hydrologic connection between upstream watersheds and the restoration site and to disable the internal drainage system on-site. The restoration process would start with activities to restore site hydrology (Barr 2008m).

The site is located outside of the NorthMet Project area watershed. The proposed wetland mitigation area includes ~~313~~ 0286.2 acres of wetland restoration and ~~79.2~~91.2 acres of upland buffer preservation. Restoration methods on the site are designed to restore the following wetland types: ~~(Type 1) seasonally flooded,~~ (Type 2) (fresh wet meadow), (Type 2) (sedge meadow), ~~(Type 3) shallow marsh,~~ (Type 6) (shrub-carr), (Type 6) (alder thicket), and (Type 7) (hardwood swamp)~~, (Type 7) coniferous swamp, and (Type 8) coniferous bog~~.

Hydrology monitoring at the Hinckley site began in 2014, as well as at two reference wetland sites, to characterize the pre-restoration hydrology (PolyMet 2015c). Results of 2014 monitoring would be submitted to the USACE and the MDNR in 2015. Concurrence of the monitoring results would be conducted by permitting agencies during the permitting process (PolyMet 2015c). The state and federal agencies have not yet made a determination on the drainage status of the mitigation site (i.e., drained, partially drained, etc.); this determination would be made during permitting, including credit ratios.

The minimum replacement ratio that would be allowed by the USACE is 1:1 (USACE 2009) for those wetlands that are replaced with the same wetland type, and at least one full growing season in advance of the authorized wetland ~~effects~~ impacts provided initial performance standards are met; however, base compensation ratios ~~could be increased to 2:1~~ for ~~effects~~ impacts on high-quality, difficult-to-replace bog and forested wetlands would be increased to 2:1(USACE 2013). For ~~effects~~ impacts on low- and moderate-quality wetlands, a base ratio of 1.5:1 would be applied (USACE 2013). In-kind, in-place, and in-advance incentives to reduce the recommended base ratios would be considered at the time of permitting (see Table 5.2.3-18 and Table 5.2.3-19). Compensation proposed at the Hinckley Site would be expected to meet the in-kind incentive, resulting in a compensation ratio for high-quality wetland ~~effects~~ impacts of 1.75:1, and if in-advance, the ratio would be reduced to 1.5:1. For low- to moderate-quality wetlands, the recommended base ratio of 1.5:1 would be required and could be reduced to 1.25:1 if in-kind and 1:1 if also in-advance.

Under the Minnesota WCA, the replacement ratio that would likely be ~~allowed~~ required is 1.5:1, because the Hinckley Site ~~for those~~ wetlands ~~that are replaced with the same wetland type and~~ out of the NorthMet Project area watershed (see Tables 5.2.3-18 and 5.2.3-20).

The site-specific mitigation design proposed by PolyMet includes the following methods of restoration to receive wetland mitigation credits, which will be approved during permitting:

- restoration of effectively drained wetlands (restoration via reestablishment) on ~~306.1~~277.4 acres for 100 percent mitigation credit or ~~306.1~~277.4 credits;
- hydrologic restoration of ~~6.9~~8.7 acres of partially drained wetlands (restoration via rehabilitation) to receive 50 percent credit or ~~3.5~~4.4 credits; and
- restoration of native vegetation on ~~79.2~~91.2 acres of uplands and filled ditches, for ~~19.8~~22.8 credits based on the 25 percent credit calculation for upland buffer.

The vegetation and hydrology would likely be restored to the site over a 1- to 2-year construction period, followed by ~~10~~ up to 20 years of management or more, if warranted. The restoration work is expected to begin on the site after permit approval such that the initial phases of the restoration would be completed more than one full growing season before the ~~effects~~ impacts of the NorthMet Project Proposed Action would occur (PolyMet 2013q). Performance standards have been developed for the mitigation site to guide the restoration activities and to monitor whether vegetation and hydrology are meeting the design goals. To protect the site, a ~~A~~ permanent conservation easement or deed recording ~~or deed restriction~~ would be prepared and recorded at approval of permit or prior to impact, as required by the permitting agency~~to protect the site within 1 year after initializing the restoration activities~~. The wetland restoration area would be monitored for up~~10~~ to 20 years beginning in the first full growing season after completing hydrologic restoration and ending upon certification by the USACE and MDNR that the wetlands have met performance standards (~~PolyMet 2013h;~~ PolyMet 2013q; PolyMet 2015c).

The objective is to restore the hydrologic connection between the upstream watersheds and the site and disable the internal drainage system within the site. The hydrology would be restored by filling ditches and utilizing broad, rock-lined overflow weirs, eliminating culverts, where possible, to establish specific hydrologic conditions that would meet the goals and performance standards established for the site and approved by the appropriate agencies. Once hydrology

restoration has been achieved, an adaptive management program is proposed to guide development of the restored wetlands to achieve the targeted conditions. The vegetative restoration of the herbaceous layer in each wetland community would be conducted to promote the establishment of characteristic native species that are present in the seed bank or that may be transported to the area from adjacent wetlands. The goal of the restoration is to provide a setting and conditions in which the restoration areas would be restored to naturally self-sustaining and functioning wetlands to the extent feasible. The proposed wetland communities have been planned in areas that appear to match the natural hydrologic characteristics of each community type. However, during the restoration process, it is expected that the defined areas and wetland communities may change to some degree and the plan will allow for adaptation to the conditions. The overall plan for the Hinckley Site includes the following components: general site preparation, natural regeneration in all proposed communities, seeding/planting of sedge/wet meadow and shrub-carr/alder-thicket communities, management of the existing hardwood swamp community, and upland area management. ~~The vegetative restoration of each non-forested, non-bog community would be conducted to promote the establishment of characteristic native species that are present in the seed bank or that may be transported to the area from adjacent wetlands.~~ General site preparation would be prior to or concurrent with hydrological restoration activities. Existing, non-native, and invasive vegetation would be removed through mechanical means or herbicide application. Diverse, native wetland vegetation is expected to develop in the restoration wetlands from the existing seed bank and from the wetland vegetation that surrounds the wetland restoration site through vegetative propagation and seed dispersal mechanisms. At the end of the second growing season, these areas would be assessed to determine if additional seeding is required. These areas include sedge and wet meadows and ~~,~~ ~~shallow and deep marsh, emergent fringes,~~ shrub-carr, ~~/~~and alder thickets.

The existing hardwood swamp would be managed to minimize the prevalence of non-native, invasive species; however, it is not anticipated that active seeding and planting would be required. ~~Hardwood and coniferous swamp along with open and coniferous bogs would require herbaceous and woody species seeding as well as some woody seedling installation. Open and coniferous bogs would also require the installation of a sphagnum moss layer. The Mine Site may provide up to half the donor soil material (i.e., sphagnum) for this mitigation site.~~

Vegetation in the existing upland areas would be managed to promote natural succession of the existing plant communities. The primary maintenance activity would be control of non-native invasive species such as buckthorn, honeysuckle, reed canary grass, and garlic mustard.

Zim Site

The Zim site is currently an active sod farm that has been drained by ditches and sub-surface drain tiles. This site is located in two separate units (north and south) on approximately 569 acres of land located southwest of the city of Eveleth, Minnesota. The site is located in St. Louis County in the St. Louis River major watershed (#3), within the Lake Superior basin (bank service area #1). The overall objective of the Zim restoration plan is to restore a native wetland plant community.

The site is located within the NorthMet Project area watershed. The proposed wetland mitigation area includes ~~508.2~~508.2 acres of wetland restoration and preservation, and 22.7 acres of upland buffer preservation. Restoration methods on the site would be designed to restore a (Type 8) coniferous bog community; however, developing a bog community is highly dependent on soil

and groundwater parameters that are difficult to control. Therefore, a coniferous swamp community would be the contingent community if the soil and groundwater conditions are not adequate for bog regeneration. Coniferous bog or swamp is the target for the whole site; however, where trees do not successfully establish, the target community would be a shallow, open water wetland~~sedge meadow or open bog~~. If the target community changes, the credit ratios would be recalculated and would be determined ~~by the USACE and MDNR~~ during the permitting process.

Hydrology monitoring at the Zim site began in 2012, as well as at a reference wetland site, to characterize the pre-restoration hydrology, and continued in 2013 and 2014 (PolyMet 2015c). Based on 2 years of monitoring data at the Zim Site, the majority of the sod fields on the site no longer have wetland hydrology. The forested locations on the Zim Site exhibit hydrology representative of partially drained wetlands. Results of 2014 monitoring would be submitted to the USACE and the MDNR in 2015. Concurrence of the monitoring results would be conducted by permitting agencies during the permitting process (PolyMet 2015c). The state and federal agencies have not yet made a determination on the drainage status of the mitigation site (i.e., drained, partially drained, etc.); this determination would be made during permitting, including credit ratios.

The minimum replacement ratio that would be allowed by the USACE is 1:1 (USACE 2009) for those wetlands that are replaced with either the same wetland type, or at least one full growing season in advance of the authorized wetland ~~effects~~ impacts provided initial performance standards are met; however, base compensation ratios ~~could be increased to 1.5:1~~ for impacts ~~effects~~ on high-quality, difficult-to-replace bog and forested wetlands would be increased to 2:1 (USACE 2013). For impacts ~~effects~~ on low- and moderate-quality wetlands, a base ratio of 1.5:1 would be applied (USACE 2013). In-kind, in-place, and in-advance incentives to reduce the recommended base ratios would be considered at the time of permitting (see Tables 5.2.3-18 and 5.2.3-19). Compensation proposed at the Zim Site would be expected to meet both in-kind and in-place incentives, thereby reducing the compensation ratio for high-quality wetland impacts ~~effects~~ from 2:1 to 1.5:1. If in-advance, the ratio would be further reduced to 1.25:1. For low- to moderate-quality wetlands, the recommended base ratio of 1.5:1 would be required and could be reduced to 1.25:1 if in-~~kind~~ place and 1:1 if also in-advance or in-kind. Under the Minnesota WCA, the replacement ratio that would likely be ~~allowed~~ required is 1:1 for those wetlands that are replaced with the same wetland type and in the same watershed (see Table 5.2.3-18 and Table 5.2.3-20).

The site-specific mitigation design proposed by PolyMet includes the following methods of restoration to receive wetland mitigation credits, which will be approved during permitting:

- restoration of effectively drained wetlands on 401.5 acres for 100 percent mitigation credit or 401.5 credits;
- ~~creation~~ restoration of 8.3 acres of excavated ponds for 100 percent mitigation credit or 8.3 credits;
- hydrologic restoration of 48.1 acres of partially drained wooded wetlands to receive 50 percent credit or 24.1 credits;

- restoration of natural surface grade and wetland conditions in 21.5 acres of ditches, which would be filled to receive 50 percent credit or 10.~~8~~ 7 credits;
- restoration of native vegetation on 22.7 acres of upland buffers within drained fields ~~effectively drained wetlands~~ and filled ditches, each of which would remain drained due to open ditches that cannot be filled, for 5.7 credits based on the 25 percent credit calculation for upland buffer; and
- easement protection of 28.8 acres of native coniferous bog communities at 12.5 percent credit for a total of 3.6 credits for preservation.

The vegetation and hydrology would be restored to the site over a 1- to 2-year construction period, followed by up ~~10~~ to 20 years of management or more, if warranted. The restoration work is expected to begin on the site after permit approval such that the initial phases of the restoration would be completed more than one full growing season before the impacts ~~effects~~ of the NorthMet Project Proposed Action would occur (PolyMet 2013q). Performance standards have been developed for the mitigation site to guide the restoration activities and to monitor whether vegetation and hydrology are meeting the design goals (Barr 2011k). To protect the site, a~~A~~ permanent conservation easement or deed recording ~~restriction~~ would be prepared and recorded ~~to protect the site~~ at approval of permit or prior to impact, as required by the permitting agency~~within 1 year after initializing the restoration activities~~. The wetland restoration area would be monitored for up~~10~~ to 20 years beginning in the first full growing season after completing hydrologic restoration and ending upon certification by the USACE and MDNR that the wetlands have met performance standards (~~PolyMet 2013h;~~ PolyMet 2013q; PolyMet 2015c).

The objective is to restore hydrology within the site by filling the interior ditches, leveling the raised berms, and disabling drain tiles to establish specific hydrologic conditions that would meet the goals and performance standards established for the site and approved by the appropriate agencies. Once hydrology restoration has been achieved, an adaptive management program is proposed to guide development of the restored wetlands to achieve the targeted conditions. Coniferous bog or swamp communities would be established using established and approved bog restoration methods. Native, harvested bog material would be spread throughout the site to facilitate the re-introduction of sphagnum mosses and other bog species that cannot be easily re-introduced by seed. Natural re-generation of the herbaceous ground cover, in combination with the addition of bog harvest materials, would be supported by intensive weed management. Tree and shrub seedlings would be installed by hand throughout the site. The site would be carefully monitored and managed and supplemental plantings and seeding may be used to encourage development until performance standards are met. The overall plan for the Zim Site includes the following components: general site preparation, site grading and hydrology restoration, bog restoration methods, tree and shrub installation, natural regeneration and bog establishment, and supplemental planting and seeding.

Table 5.2.3-18 Summary of Proposed Wetland Mitigation Credits

Community/Credit Type	Wetland Mitigation Within Project Watershed[1]		Wetland Mitigation Outside Project Watershed[1]			Total Wetland Mitigation Acres[1]	Total Wetland Mitigation Credits[1,65]
	Zim Sod (acres)~~On-site (acres)~~	Total Credits	Aitkin (acres)	Hinckley (acres)	Total Credits		
Off-site Restoration of Effectively Drained Wetlands[21]							
~~Deepwater~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~
~~Type 1 Seasonally Flooded~~	~~0.0~~	~~0.0~~	~~0.0~~	~~20.1~~	~~20.1~~	~~20.1~~	~~20.1~~
Type 2 Fresh (Wet) Meadow	0.0~~---~~	0.0	0.021.8	0.014.3	0.036.1	0.036.1	36.10.0
Type 2 Sedge Meadow	0.0~~---~~	0.0	0.047.1	51.039.1	51.086.2	51.086.2	51.086.2
Type 3 Shallow Marsh	0.0~~---~~	0.0	25.786.9	0.01.4	25.788.3	25.788.3	25.788.3
Type 4 Deep Marsh	0.0~~---~~	0.0	0.033.6	0.0	0.033.6	0.033.6	0.033.6
Type 5 Shallow, Open Water	8.3~~---~~	8.3	0.0	0.0	0.0	8.3	8.3
Type 6 Shrub-Carr	0.0~~---~~	0.0	0.083.9	113.287.1	113.271.0	113.271.0	113.2171.0
Type 6 Alder Thicket	0.0~~---~~	0.0	0.082.8	113.227.4	113.20.2	113.20.2	113.2110.2
Type 7 Hardwood Swamp	0.0~~---~~	0.0	171.052.6	0.07.1	171.059.7	171.059.7	171.059.7
Type 7 Coniferous Swamp	0.0~~---~~	0.0	561.689.1	0.08.4	561.697.5	561.697.5	561.697.5
Type 8 Open Bog	0.0~~---~~	0.0	0.074.2	0.0	0.074.2	0.074.2	0.074.2
Type 8 Coniferous Bog	401.5~~---~~	401.5	0.0238.2	0.0101.2	0.0339.4	401.5740.9	401.5740.9
Off-site Restoration of Partially Drained Wetlands and Ditches[32]							
Type 2 Sedge Meadow	0.0~~---~~	0.0	0.0	0.8	0.4	0.8	0.4
Type 3 Shallow Marsh	0.0	0.0	13.6	0.0	6.8	13.6	6.8
Type 6 Shrub-Carr	0.0~~---~~	0.0	36.50.0	0.0	18.20.0	36.50.0	18.20.0
~~Type 7 Coniferous Swamp~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	0.0
Type 7 Hardwood Swamp	0.0~~---~~	0.0	0.0	7.96.1	4.03.1	7.96.1	4.03.1
Type 8 Coniferous Bog	69.6~~---~~	34.8	0.0	0.0	0.0	69.6	34.8
Off-site Site Preservation[43]							
Type 8 Coniferous Bog	28.8~~---~~	3.6	0.0	0.0	0.0	28.8	3.6
Off-site Upland Buffer	22.7~~---~~	5.7	~~123.1~~83.2	~~79.2~~91.2	43.650.6	197.0225.0	~~56.3~~49.3
On-site Wetland	~~---101.8~~	---	---	---	---	~~---101.8~~	---

On-site Upland Buffer[54]	------	---	---	---	---	---	---
Upland Buffer Total[1]	22.7---	5.7	123.183.2	79.291.2	43.650.6	197.0225.0	49.356.3
Wetland Total[1]	508.2101.8	448.2	810.2808.3	286.2313.0	1,065.1119.8	1,602.7733.2	1,513.368.0
Total [1]	530.9101.8	453.9	933.3891.5	377.3392.2	1,108.770.3	1,799.7958.2	1,562.5624.2

Source: PolyMet 2013q2015c.

[1] Totals may not add exactly due to rounding.
[2] Credits for restoration of completely drained wetlands are worth 100 percent of the acreage restored based on USACE St. Paul District Policy (Restoration via re-establishment) and the Minnesota WCA Chapter 8420.0526, Subpart 3.
[32] Credits for restoration of partially drained wetlands are worth 50 percent of the acreage restored based on USACE St. Paul District Policy (Restoration via rehabilitation) and the Minnesota WCA Chapter 8420.0526, Subpart 4.
[43] Credits for wetland preservation are worth 12.5 percent of the acreage protected under a conservation easement based on USACE St. Paul District Policy (Preservation) and the Minnesota WCA Chapter 8420.0526, Subpart 9 (per *Minnesota Statute* 103G.2251 modified August 1, 2011).
[54] Credits for upland buffers are worth 25 percent of the acreage of native, non-invasive vegetation established or maintained adjacent to the wetland based on USACE St. Paul District Policy (Preservation) and the Minnesota WCA Chapter 8420.0526, Subpart 1.
[65] The determination of final mitigation credits required to offset the impactseffects of the proposed NorthMet Project Proposed Action would be determined by the agencies during wetland permitting. The public notice for the DA permit application will be reissued when the SDEIS becomes available.

Table 5.2.3-19 Summary of Proposed Wetland Mitigation for Direct ~~Effects~~ Impacts Utilizing USACE Credits

Wetland or Credit Type	Mitigation Credits Available[1]				NorthMet Project Proposed Action Direct Wetland ~~Effects~~ Impacts in Acres[1,~~2~~3]			Total Credits Required for Mitigation at Base Ratio[1,~~9~~10]	No More Than 2 Apply[~~9~~10]			Total Applied Mitigation Credits[1,6,~~7~~7,~~8~~,~~10~~2]	Applied Mitigation Ratio[~~8~~9,~~9~~10]
	Zim Sod	Aitkin	Hinckley ~~XXOn-Site~~[~~2~~]	Total Mitigation Credits Available	Non-Forested, Non-Bog, and Low or Medium Quality Wetland (Base Ratio 1.5:1)[~~3~~4]	Bogs, Forested, and High Quality Wetland (Base Ratio 2:1)[~~4~~5]	Total Impact Acres		Incentive for Credits In-Kind -0.25:1	Incentive for Credits In-Place -0.25:1	Incentive for Credits In-Advance[~~5~~6] -0.25:1		
~~Deepwater~~	~~0.0~~	~~0.0~~	~~0.0~~	**~~0.0~~**	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	---	---	---	**~~0.0~~**	~~0~~
~~Type 1 Seasonally Flooded~~	~~0.0~~	~~0.0~~	~~20.1~~	**~~20.1~~**	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	---	---	---	**~~0.0~~**	---
Type 2 Fresh (Wet) Meadow	0.0	~~21.8~~0.0	0.0~~14.3~~	**~~36.1~~0.0**	1.4	14.4	15.8	30.9	~~(4.0)~~---	---	~~(4.0)~~---	**~~23.0~~30.9**	1.46~~9~~
Type 2 Sedge Meadow	0.0	~~47.1~~0.0	51.4~~39.5~~	**~~86.6~~51.4**	6.8~~9~~	17.1	23.9	44.3~~4~~	(6.0)	---	---	**38.3~~4~~**	1.61
Type 3 Shallow Marsh	0.0	~~86.9~~32.5	0.0~~1.4~~	**~~88.3~~32.5**	53.1	23.9	77.0	127.5	(~~19.3~~8.1)	---	(~~19.3~~8.1)	**~~89.0~~111.3**	1.~~44~~16
Type 4 Deep Marsh	0.0	~~33.6~~0.0	0.0---	**~~33.6~~0.0**	73.~~64~~.2	0.1	~~73.7~~74.3	110~~1.5~~.6	~~(8.4)~~---	---	~~(18.4)~~---	**111.~~583.7~~**	1.~~14~~50
Type 5 Shallow, Open Water	8.3	0.0	0.0---	**8.3**	0.0	0.0	0.0	0.0	---	---	---	**0.0**	---
Type 6 Shrub-Carr	0.0	18.2~~83.9~~	113.2~~87.1~~	**~~171.0~~31.5**	1.4	2.5	3.9	7.1	(1.0)	---	---	**6.1**	1.57
Type 6 Alder Thicket	0.0	0.0~~82.8~~	113.2~~27.4~~	**110~~3~~.2**	7.5	103.1	110.6	217.4	(27.6)	---	---	**189.8**	1.72
Type 7 Hardwood Swamp	0.0	171.0~~52~~.~~6~~	4.0~~10.2~~	**62.8~~175.0~~**	0.0~~7~~	12.5	~~12.5~~13.2	24.~~9~~6.0	(3.3~~1~~)	---	---	**22.~~7~~1.8**	1.72~~5~~
Type 7 Coniferous Swamp	0.0	561.6~~89.1~~	0.0~~8.4~~	**~~97.5~~561.6**	0.0	84.~~4~~	84.~~4~~	168.9	(21.1)	---	---	**147.8**	1.75
Type 8 Open Bog	0.0	0.0~~74.2~~	0.0---	**~~74.2~~0.0**	0.0	7.6	7.6	15.3	~~(1.9)~~---	---	---	**~~15.3~~3.~~4~~**	2.00~~1.75~~
Type 8 Coniferous Bog ~~(in watershed)~~	~~440.0~~39.9	0.0	0.0---	**~~440.0~~39.9**	0.0	530.0	530.0	1,060.0	(13~~2.5~~10.0)	(110.0)	---	**8~~40.0~~17.5**	1.58~~4~~
~~Type 8 Coniferous Bog (out-of-watershed)~~	~~0.0~~	~~238.2~~	~~101.2~~	**~~339.4~~**						---			
~~Wetland - In-Kind/In-Place~~	---	---	---	**~~0.0~~**	---	---	---	---	---	---	---	---	---
Wetland Total[1]	448.2~~3~~	783.3~~81~~ 0.2	~~309.6~~281.8~~0.0~~	**1,~~56~~7,~~9~~13.3**	14~~3~~.85.2	795.6	93~~9~~,~~440~~.7	1,80~~6~~.8.9	---	---	---	**1,513.7~~430.5~~**	---1.61
Upland Buffer	5.7	2~~3~~0.8	22.8~~19.8~~---	**~~56~~49.3**	---	---	---	---	---	---	---	---[10]	---
Total[1]	**45~~3~~.9~~4.0~~**	**80~~4~~.1.0**	**~~32~~9.~~3~~04.6~~0.0~~**	**1,~~62~~4.~~2~~562.5**	**93~~9~~,~~440~~.7**			**1,80~~6~~.8.9**	**(~~22~~4.~~7~~117.1)**	**(110.0)**	**(~~41~~68.1)**	**1,~~43~~0.~~5~~513.7**	1.~~52~~61
									(~~37~~6295.2.~~3~~)				
Total Surplus Wetland Mitigation Credits for NorthMet Project Proposed Action (Total Credit Minus Total Applied Mitigation Credit)[1,~~9~~10]				**193.~~7~~48.8**									

Source: PolyMet ~~2013q~~2015c.

[1] Totals may not add exactly due to rounding.
[~~2~~] ~~No wetland types defined.~~
[~~3~~] The total includes fragmentation of wetlands that would occur at the Mine Site and Plant Site (26.9 acres).
[~~4~~] Base ratio 1.5:1 per USACE St. Paul District Policy (USACE 2009) for wetlands that are not considered high quality or difficult to replace, which includes forested wetland and bog communities.
[~~5~~] Base ratio 2:1 per USACE May 29, 2013 Draft Memorandum (USACE 2013) for wetlands that are high quality or difficult to replace, which includes forested wetland and bog communities.
[~~6~~] Based on USACE May 29, 2013 Draft Memorandum (USACE 2013) for in-advance qualification assuming all mitigation would be constructed one full growing season before wetland ~~effects~~ impacts were to occur.
[~~7~~] Total Applied Mitigation Credits = Total Credits Required for Mitigation minus Incentive Credits.
[~~8~~] Credits applied may include surplus credits from different wetland types.
[~~9~~] The ratio of credits applied to NorthMet Project Proposed Action ~~effects~~ impacts (not including the surplus credits).
[~~9~~10] The determination of final mitigation credits required to offset the ~~effects~~ impacts of the proposed NorthMet Project Proposed Action would be determined by the agencies during wetland permitting. ~~The public notice for the DA permit application will be reissued when the SDEIS becomes available.~~
[10] Includes 0.5 credit of upland buffer, applied from totals listed above.

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Table 5.2.3-20 Summary of Proposed Wetland Mitigation for Direct ~~Effects~~ Impacts Utilizing Minnesota Wetland Conservation Act Credits

Wetland or Credit Type	Mitigation Credits Available[1]				NorthMet Project Proposed Action Direct Wetland ~~Effects~~ Impacts in Acres[1,2]	Credit Applied ~~Surplus after for 1:1 In-Kind Replacement (Deficit)~~Replacement[1,6]	Additional Mitigation Required +0.5:1[3,6]	Total Mitigation Credits Applied	Applied Mitigation Ratio[9]
	Zim Sod	Aitkin	Hinckley	Total Mitigation Credits Available					
~~Deepwater~~	~~0.0~~	~~0.0~~	~~0.0~~	**~~0.0~~**	~~0.0~~	~~0.0~~	~~---~~		~~---~~
~~Type 1 Seasonally Flooded~~	~~0.0~~	~~0.0~~	~~20.1~~	**~~20.1~~**	~~0.0~~	~~20.1~~	~~---~~		~~1.5:1~~
Type 2 Fresh (Wet) Meadow	0.0	~~21.8~~0.0	0.0~~14.3~~	**0.0~~36.1~~**	15.8	~~20.3~~15.8	7.9	23.7	1.5:1
Type 2 Sedge Meadow	0.0	0.0~~47.1~~	~~51.4~~39.5	**~~86.6~~51.4**	23.9	62.7	~~11.9~~12.0	35.9	1.5:1
Type 3 Shallow Marsh	0.0	~~32.5~~86.9	0.0~~1.4~~	**~~88.3~~32.5**	~~77.0~~	~~11.3~~77.0	38.5	115.5	1.5:1
Type 4 Deep Marsh	0.0	0.0~~33.6~~	0.0	**0.0~~33.6~~**	~~73.7~~13	~~(40.1)~~74.3	37.1~~6.9~~	111.4	1.5:1
Type 5 Shallow, Open Water	8.3	0.0	0.0	**8.3**	0.0	~~8.3~~0.0	0.0	0.0	1.5:1
Type 6 Shrub-Carr	0.0	18.2~~83.9~~	113.2~~87.1~~	**~~171.0~~131.5**	3.9	3.9~~167.1~~	1.9~~2.0~~	5.8	1.5:1
Type 6 Alder Thicket	0.0	0.0~~82.8~~	113.2~~27.4~~	**~~110.2~~113.2**	110.6	110.6~~(0.4)~~	55.3	165.9	1.5:1
Type 7 Hardwood Swamp	0.0	171.0~~52.6~~	4.0~~10.2~~	**62.8~~175.0~~**	~~12.5~~13.2	13.2~~50.3~~	6.6~~2~~	19.7	1.5:1
Type 7 Coniferous Swamp	0.0	561.6~~89.1~~	0.0~~8.4~~	**~~97.5~~61.5**	84.4	84.4~~13.1~~	42.2	126.6	1.5:1
Type 8 Open Bog	0.0	0.0~~74.2~~	0.0	**0.0~~74.2~~**	7.6	7.6~~66.6~~	3.8	11.5	1.5:1
Type 8 Coniferous Bog ~~(in watershed)~~	~~440.0~~39.9	0.0	0.0	**~~439.9~~40.0**	530.0	530.0~~249.3~~	~~45.0~~---	575.0	1:1[4]
~~Type 8 Coniferous Bog (out-of-watershed)~~	~~0.0~~	~~238.2~~	~~101.2~~	**~~339.4~~**		940.7	~~45.0~~		~~1.5:1~~[7]
~~Wetland - In-Kind/In-Place~~	~~---~~	~~---~~	~~---~~	~~---~~	~~---~~	~~---~~	~~---~~		~~---~~
Wetland Total[1]	448.2~~3~~	~~810.2~~783.3	281.8~~309.6~~	**1,~~567.9~~13.3**	~~939.4~~940.7	940.7~~628.6~~	~~249.7~~250.4	1,191.2	---
Upland Buffer	5.7	~~30.8~~20.3	22.8~~19.8~~	**~~56~~49.3**	---	~~---~~56.3	---	---	---

Total[1]	**454.03.9**	**804.1.01**	**304.629.3**	**1,562.5624.2**	**939.4940.7**	**940.7684.9**	**250.449.7**	**1,191.2**	1.27:1[5]
Total Surplus Wetland Mitigation Credits for NorthMet Project Proposed Action (Total Credit minus 1:1Credits minus Additional Mitigation Required)[1,6]						**435.2371.4**			
Total Wetland Mitigation Credits Used for NorthMet Project Proposed Action[1,6]						**1,189.191.2**			

Source: PolyMet ~~2015c~~2015c

[1] Totals may not add exactly due to rounding.
~~[2] No wetland types defined.~~
[23] The total includes fragmentation of wetlands that would occur at the Mine Site and Plant Site (26.9 acres).
~~[4] Credit Surplus after 1:1 In-Kind Placement = Total Mitigation Credits Available minus Total Impact Area.~~
[35] Additional mitigation required for mitigation out of the watershed at Aitkin and Hinckley sites. Determined by multiplying 0.5 by Total Impact Area.
[4] Assume 1:1 replacement for 439.9 acres compensated in-kind and in the watershed and 1.5:1 for the remaining 90.1 acres replaced out of the watershed
~~[6] Remaining assumes 1:1 replacement since effects would be compensated in-kind and ahead of time.~~
~~[7] Excess mitigation credits calculated based on bog effects not replaced in the watershed at Zim Sod (530.0-140.0=90 times 0.5 equals 45.0 credits).~~
[58] The ratio of credits applied to NorthMet Project Proposed Action ~~effects~~ impacts (not including the surplus credits).
[69] The determination of final mitigation credits required to offset ~~effects~~ impacts of the proposed NorthMet Project Proposed Action would be determined by the agencies during wetland permitting. ~~The public notice for the DA permit application will be reissued when the SDEIS becomes available.~~

5.2.3.3.3 Mitigation Summary

Compensatory mitigation is required for the 912.53.8 acres of wetlands that would be directly affectedimpacted. In addition, compensatory mitigation for the 26.9 acres of wetland fragmentation would be provided up front. The overall wetland mitigation strategy for the NorthMet Project Proposed Action is to compensate for unavoidable wetland effects impacts in-place, in-kind where possible and in-advance of effects impacts when feasible in order to replace lost wetland functions. Due to both on- and off-site limitations and technical feasibility, it is not practicable to replace all affected impacted wetland types with an equivalent area of in-kind wetlands. A combination of Ooff- and on-site wetland mitigation projects would be implemented to fulfill the requirements for compensatory mitigation. PolyMet's current mitigation proposal includes:

- On-site mitigation totaling 101.8 acres of wetland creation during reclamation.
- Off-site mitigation including:
  - Aitkin Site – 810.2 808.3 acres of wetland restoration and 123.183.2 acres of upland buffer;
  - Hinckley Site – 313.0286.2 acres of wetland restoration and 79.291.2 acres of upland buffer; and
  - Zim Site – 508.2 acres of wetland restoration and 22.7 acres of upland buffer.

Off-site wetland compensation of 1,631.402.7 acres could provide 1,568.013.3 wetland mitigation credits. In addition, a total of 225.0 197.1 acres of upland buffer areas are proposed to be established with native vegetation around the wetland restoration areas. In accordance with USACE guidelines, credit for the upland buffer areas would be at a 4:1 ratio, resulting in an additional 5649.3 credits. The total off-site mitigation could provide 1,624.2562.5 wetland mitigation credits. Tables 5.2.3-18, 5.2.3-19, and 5.2.3-20 provide a summary of wetland mitigation. Compensatory mitigation ratios determined in permitting may vary from these assumptions.

Finally, establishment of approximately 101.8 acres of wetland would likely occur during reclamation of the Mine Site; this establishment is not included in the mitigation credits discussed above as credit is not being requested at this time.

In accordance with the Ffederal Mitigation Rule 2008, USACE policy, and overall requirements of the CWA, the primary focus of compensatory mitigation is to replace lost wetland functions within the same 8-digit HUC watershed as the impact site—in this case, the St. Louis River Watershed/Great Lakes Basin. Initially, no practicable compensation sites were found in the St. Louis River watershed, but subsequently, the Zim Site was found and incorporated as part of the compensatory mitigation plan. The permanent functional loss of wetlands within the St. Louis River Watershed/Great Lakes Basin will be considered during permitting by the USACE in its DA permit decision. This is particularly critical in that 8-digit HUC watersheds adjacent to the Great Lakes—including the St. Louis River Watershed—have been identified as coastal watersheds for purposes of the Ffederal Mitigation Rule 2008. The majority of the credits would be in-kind mitigation and nearly one-third of the credits would be from within the NorthMet Project area watershed (see Tables 5.23-18, 5.2.3-19, 5.2.3-20). Approximately 72 percent of the

~~credits proposed would be located outside of this watershed.~~ Based on PolyMet's current mitigation proposal and assuming the mitigation efforts are fully successful and target communities are established, 83 percent of the impacts to coniferous bogs would be mitigated by in-kind and in-place credits, or 439.9 coniferous bog credits; the remaining 17 percent would be replaced out-of-kind. Out-of-kind credits would be used to mitigate for impacts on wet meadow, shallow marsh, deep marsh, open bog, and coniferous bog communities; these would not be replaced in-kind because of hydrological and ecological constraints at the proposed mitigation sites. Forty seven percent of the wetland impacts are currently proposed to be replaced in-kind, in-place, and before the impacts occur on-site. An additional 29 percent of the proposed impacts are proposed to be replaced in-kind and before the impacts occur on-site. Most of the additional mitigation credits that are proposed outside of the watershed would fulfill mitigation requirements above the minimum 1:1 ratio. The preferred location of siting any additional compensatory mitigation that may be required for the NorthMet Project Proposed Action would be within the St. Louis River/Great Lakes Basin. ~~The Rule places additional emphasis on replacing coastal wetland losses within a coastal watershed. Should the USACE determine that a greater percentage of the compensation be accomplished within the St. Louis River Watershed/Great Lakes Basin, the applicant may be directed to re-evaluate compensation opportunities within that watershed.~~

The USACE requires a detailed compensatory mitigation plan for anticipated wetland impacts ~~effects~~ that would occur during the first 5 years of the NorthMet Project Proposed Action. A detailed mitigation plan must be submitted for each subsequent 5-year increment of wetland impacts ~~effects~~ to the USACE for approval. The anticipated wetland types to be restored off-site include a combination of the same and different types as the ~~affected~~ impacted wetlands. Some off-site wetlands would be restored in advance of impacts~~effects~~, while other wetlands would be restored after the impacts~~effects~~.

The change in wetland hydrology from groundwater drawdown at the Mine Site was assessed by two different methodologies; therefore, total indirect wetland effects were provided based on both approaches. The NorthMet Project Proposed Action could indirectly affect up to either 7,~~3~~694.2~~50.7~~ acres of wetlands located within and around the NorthMet Project area, based on the method of wetlands crossing analog impact zones, or up to 6,4~~5~~68.8~~98.1~~ acres of wetlands located within and around the NorthMet Project area, based on the method of wetlands within analog impact zones (PolyMet ~~2013k~~2015b; ~~PolyMet 2013q~~). Regardless of the method used, wetland mitigation for indirect wetland effects would be determined by the agencies during permitting. If the NorthMet Project Proposed Action were to be permitted and constructed, wetland monitoring would be conducted to determine if the NorthMet Project Proposed Action ~~would~~ cause~~s~~ future indirect wetland effects. Wetlands and vegetation would be monitored~~;~~, ~~and~~ additional monitoring locations may be considered during permitting. A component of the monitoring plan would be based on those wetlands that have a high likelihood of indirect effects as a result of groundwater drawdown. If the monitoring determined that indirect wetland effects had occurred, additional compensation may be required if determined necessary by the permitting agencies. In the event that the wetland monitoring identified additional indirect effects, appropriate measures (i.e., adaptive management practices) would be implemented such as hydrologic controls or additional compensatory mitigation. Permit conditions would likely include an adaptive management plan to account for any additional effects that may be identified in the annual monitoring and reporting.

5.2.3.3.4 Monitoring Plan for Mitigation Sites

Wetland hydrology monitoring has begun ~~would be performed~~ at the mitigation sites to assess hydrological conditions prior to the NorthMet Project Proposed Action and would continue after hydrology restoration is complete to determine whether or not the ~~within the NorthMet Project area to demonstrate performance of wetland mitigation and to determine if indirect wetland effects were occurring. Monitoring of the~~ restored wetland areas ~~would assess whether or not the restored wetlands~~ are in conformance with performance standards and would determine whether continued monitoring would be required.

The wetland restoration area monitoring would begin during the first full growing season after completing hydrologic restoration. In addition to monitoring of the restored wetlands, one reference wetland of each restoration community type would be monitored within the general area of each restoration site in areas with relatively natural hydrologic conditions similar to that of the proposed target communities. A monitoring plan would be submitted to the appropriate state and federal agencies for review and approval that would include proposed locations of reference wetlands prior to implementing the monitoring program (PolyMet 2013q; PolyMet 2015c).

Vegetative monitoring would entail conducting a detailed vegetation survey at least once per year (typically July to August) in each wetland mitigation community, as well as the reference wetland communities, to evaluate the success of the restoration during the appropriate monitoring period for each community type.

Hydrologic monitoring would involve the installation and periodic monitoring of shallow recording wells at multiple locations sufficient to characterize hydrology. Continuous recording wells that record water table elevations multiple times each day would be utilized to the extent feasible and would be placed throughout the sites sufficient to characterize hydrology. Hydrologic monitoring would be used to measure the success of hydrologic restoration relative to the established performance standards for each community type and to assess the extent of wetlands on each site (PolyMet 2015c; PolyMet 2013q). Water elevations would be recorded at least once per week from May through mid-July and monthly thereafter until the end of the growing season (PolyMet 2015c).

The duration of monitoring would depend on the target wetland communities at each site and the success of establishment of those communities. Bogs and forested wetlands would be monitored for up to 20 years, or more if warranted. Monitoring of emergent and shrub-carr wetland communities would continue for up to 10 years, or more if warranted. Certain components of the monitoring may be discontinued sooner if performance standards were met and approval was provided by the USACE and MDNR (PolyMet 2013h; PolyMet 2013q).

~~Water monitoring is discussed in Section 5.2.2.3.6. Water quality would be monitored downstream and piezometers would be located in the wetlands.~~

~~Off-site Wetland Monitoring~~

~~Several shallow water table monitoring wells were installed on the Zim site and a reference wetland in May 2012 to characterize the pre-restoration hydrology and continue until the initiation of restoration.~~ After restoration, the monitoring design may be altered to better characterize restored conditions (PolyMet 2013q). ~~Hydrology monitoring wells would be~~

~~removed from Zim at the end of year 5, if the hydrology performance standards were met (Barr 2011k).~~

~~Hydrologic monitoring at the Aitkin and Hinckley sites would be completed with monitoring stations in each community type to document water levels relative to reference monitoring wells and proposed performance standards. Monitoring would be conducted in the shallow marsh (Type 3) and deep marsh (Type 4) communities using staff gages or modified stilling wells.~~ Water levels would be recorded several times each day in the stilling wells for the duration of the growing season; staff gauges would be checked weekly for the first 10 weeks of the growing season and twice monthly thereafter. Hydrology monitoring in saturated soil communities would be completed using shallow water table monitoring wells within each community recorded several times each day for the duration of the growing season (PolyMet 2013q). Hydrologic parameters for Hinckley and Aitkin would be evaluated in the mitigation areas more intensively during the first 2 years and then would be performed at a level appropriate to the hydrologic characteristics of each area thereafter (PolyMet 2014h; PolyMet 2014i; PolyMet 2014j)~~(Barr 2008m)~~. Reference wells would be established for each community type and monitoring with those wells would continue for the duration of site hydrology monitoring (PolyMet 2013q).

Hydrologic monitoring at the three mitigation sites would generally occur for at least 5 years; however, certain wetland types may be monitored longer. In shrub communities, monitoring would generally be for 8 years and in forested communities it would generally be 20 years. Monitoring will begin in the first full growing season after beginning hydrologic restoration, to document the progress and condition of the wetland communities at the mitigation site. Monitoring reports would be prepared and submitted to the appropriate agencies, and the frequencies of the reports would be based on permit conditions. The monitoring report completed after the final growing season would assess whether or not the restored wetlands are in conformance with performance standards ((PolyMet 2014h; PolyMet 2014i; PolyMet 2014j).

~~Monitoring reports would be prepared and submitted for Zim in years 1, 3, 5, 8, 10, 15, and 20, as necessary, after restoration is complete. The monitoring report completed after the tenth growing season would assess whether or not the restoration was sufficiently complete and whether or not additional monitoring and reporting were needed. A monitoring report for Hinckley and Aitkin, respectively, would be prepared annually during the first 5 years of monitoring. After year 5, monitoring reports would be provided following growing seasons 8 and 10 for the shrub communities and following growing seasons 8, 10, 15, and 20 for the forested and bog communities.~~ Reports would describe the status of the wetland mitigation, summarize the results of the vegetative and hydrologic monitoring, discuss management activities and corrective actions conducted during the previous ~~year~~period, and discuss activities planned for the following ~~year~~period. The reports would be submitted to the USACE and MDNR by December 31 of each year. Monitoring requirements would be determined during the permitting process.

Contingencies for Unsuccessful Mitigation

If the restored wetland communities at any of the mitigation sites did not meet performance standards, remedial or corrective actions and possibly additional mitigation credits may be required and would be determined by the USACE and state ~~MDNR~~ during the permitting process. ~~F~~for example, ~~–~~ PolyMet ~~c~~would characterize site conditions relative to the performance standards in each monitoring report and, if the standards were not met, remedial actions would

be proposed to meet the standard(s). The following contingencies have been proposed by PolyMet (PolyMet 2013q) and would be finalized and approved during permitting:

- Performance standards within any planned community type not met for three consecutive years would be analyzed to determine the effects on the approved wetland mitigation credits and propose an alteration to the plan, which could include a modification of wetland community type, changes to the proposed credit ratios, and additional wetland mitigation.
- If any wetland community has not developed as planned and as defined in the performance standards after the fifth full growing season after restoration, PolyMet would work with the USACE and MDNR on appropriate alternative plans, including alternative mitigation or revisions to the overall mitigation ratio based on changes to wetland community types.
- Any plan revisions would be submitted to the USACE and MDNR for review and approval prior to implementation.

If it is determined that additional wetland mitigation would be required due to unsuccessful mitigation restoration, PolyMet would first utilize the excess credits (see Tables 5.2.3-19 and 5.2.3-20) and then would identify and pursue wetland mitigation opportunities, including wetland preservation options, within the watershed of the NorthMet Project area. PolyMet would use available information from BWSR and other relevant entities that is available at the time it is determined additional potential wetland mitigation is needed. Information on the wetland mitigation opportunities identified and pursued would be coordinated with and submitted to the USACE and state for review and approval prior to making final decisions on additional mitigation (PolyMet 2013q).

5.2.3.3.5 Monitoring Plan for Mine Site and Plant Site Wetland for Potential Indirect Effects

Wetland monitoring would occur in and around the Mine Site and Plant Site prior to and during construction and operation of the NorthMet Project Proposed Action, and would be used to assess whether or not potential indirect effects on wetlands were occurring.
~~***Monitoring of Mine Site and Plant Site Wetlands for Potential Indirect Effects***~~

If monitoring of wetlands for potential indirect effects did determine effects were occurring, additional compensation may be required, if determined necessary, based on monitoring results. Monitoring is proposed within all wetlands containing a potential indirect wetland impact factor rating of 3 to 5 and a sampling of those wetlands with factor ratings of 1 or 2 (see Figures 5.3.2-31 and 5.2.3-32) (PolyMet 2013q). A component of the monitoring plan would be based on those wetlands that would have a high likelihood of indirect effects as a result of groundwater drawdown. ~~The Section 404 permit application includes criteria on how effects would be assessed. If indirect wetland effects, based on the criteria presented in the Section 404 permit application,~~ were to occur, PolyMet would work with the USACE and ~~MDNR~~state to respond, which may include the option to provide compensatory mitigation for any documented indirect effects. ~~An adaptive approach would be used to evaluate the most effective monitoring strategy for potential indirect effects.~~ The monitoring plan would be updated annually based on results from the previous year. A total of ~~42~~56 monitoring wells and four reference wells are proposed to document potential indirect wetland effects ~~(PolyMet 2013h; PolyMet 2013q)~~.

The criteria for determining if potential indirect wetland effects are occurring is provided below. In addition, p~~P~~ermit conditions would ~~likely~~ include an adaptive management plan, summarized below, to account for any additional effects that may be identified in the annual monitoring and reporting. To determine if indirect effects ~~would~~ occur, hydrology, vegetation, and wetland boundaries would be monitored, documented, and compared with baseline monitoring and reference wetlands. ~~The Section 404 permit application includes criteria on how effects would be assessed. If indirect wetland effects, based on the criteria presented in the Section 404 permit application, were to occur, PolyMet would work with the USACE and MDNR to respond, which may include the option to provide compensatory mitigation for any documented indirect effects. An adaptive approach would be used to evaluate the most effective monitoring strategy for potential indirect effects. The monitoring plan would be updated annually based on results from the previous year. A total of 42 monitoring wells and four reference wells are proposed to document potential indirect wetland effects (PolyMet 2013h; PolyMet 2013q).~~

Pre-Project Wetland Hydrology Monitoring Sites

In 2005, 20 shallow manual wells and four recording wells were initially installed at 19 locations around the Mine Site. A total of 11 monitoring locations were situated around the perimeter of the Mine Site and are not expected to be affected by the NorthMet Project Proposed Action. The remaining eight monitoring locations are located within the Mine Site and have the potential to be affected by the NorthMet Project Proposed Action. In 2008, two wells were removed because they were within future stockpile locations, two new wells were added at the Mine Site, one well was relocated out of the direct effect area, and two wells were installed in reference wetlands located west of the Mine Site (PolyMet ~~2013b~~2015c). Furthermore, in 2008, all monitoring locations were instrumented with recording wells so water levels could be recorded every 2 to 4 hours. In 2010, two wells were relocated because they were determined to be in areas that would be directly ~~affected~~ impacted by the NorthMet Project Proposed Action ~~(PolyMet 2013b)~~. During 2008 through 2010, there were 21 locations monitored at the Mine Site. In 2014, wetland monitoring locations were installed at 25 additional locations at the Mine Site and Transportation and Utility Corridor. In addition, in 2014, another reference wetland was selected, for a total of three reference wetlands to monitor (see Figure 5.2.3-31) (PolyMet 2015c). Pre-project monitoring did not include collection of vegetation or wetland boundaries other that what was completed during the wetland delineation and baseline wetland type evaluation (PolyMet 2015c~~3h~~; PolyMet 2013q).

Shallow monitoring wells were installed at eight locations around the Plant Site in 2010. One of the eight wells was installed in a reference wetland located north of the Plant Site that would not be affected by the NorthMet Project Proposed Action. Two monitoring wells were placed west of the Plant Site along Unnamed Creek; two wells were placed north of the Plant Site, adjacent to a large deep marsh wetland complex; and three wells were placed along the flowpath of Trimble Creek. The monitoring wells were typically placed to a depth of 2 to 5 ft bgs. In 2014, shallow monitoring wells were installed at seven additional locations in the Plant Site area and a second reference wetland was selected (see Figure 5.2.3-32).

The monitoring protocol would continue for the life of the NorthMet Project Proposed Action, though portions of the monitoring design could be altered to improve the design or to eliminate unnecessary data collection, which would be done in coordination with the appropriate agencies. Pre-project hydrology monitoring of wetlands and groundwater within and surrounding the Mine

Site started in 2005 and in 2010 at the Plant Site at well locations approved by the USACE and MDNR, and would continue throughout the NorthMet Project Proposed Action in accordance with the planned study (PolyMet ~~2013b~~2015c). The primary objectives of the Mine Site and Plant Site wetland hydrology monitoring studies include the following:

1. Gain a better understanding of the wetland hydrology at the Mine Site and Plant Site (i.e., defining whether specific wetlands are recharging the surficial deposits aquifer or are discharging to surface waters).
2. Collect baseline hydrology data at the Mine Site and Plant Site that could be used to assess the effect of the NorthMet Project Proposed Action on wetland hydrology.
3. Review the data collected at the Mine Site in the hydrogeologic study along with the wetland hydrology data to determine whether specific wetlands within the Mine Site area have perched water tables or are in direct hydrologic connection with the surficial deposits aquifer.
4. Determine the potential for indirect wetland effects at the Mine Site and Plant Site resulting from the NorthMet Project Proposed Action.

The majority of the pre-project monitoring locations would be utilized for future monitoring during mining activities. The monitoring of the well locations would be expanded to include vegetation sampling and wetland boundaries, and additional monitoring locations may be considered during permitting. ~~Details of the vegetation and wetland boundary monitoring are presented in the Section 404 permit application. Six existing wells at the Mine Site would be removed due to either being located within areas of direct project effects or areas where no potential indirect effects would likely occur. Wetland hydrology monitoring would be conducted during operation of the NorthMet Project Proposed Action to document indirect wetland effects. Prior to the start of the NorthMet Project Proposed Action, monitoring would be established based on permit conditions, which would describe the purpose, methods, and criteria to be implemented to document indirect wetland effects.~~

Project Wetland Hydrology Monitoring Sites

Wetland hydrology monitoring would be conducted during operation of the NorthMet Project Proposed Action to document indirect wetland effects. Prior to the start of the NorthMet Project Proposed Action, monitoring would be established based on permit conditions, which would describe the purpose, methods, and criteria to be implemented to document indirect wetland effects. As previously stated, ~~In addition to the existing wetland monitoring locations, additional monitoring locations would be installed. The additional monitoring locations would occur in areas that lack an existing monitoring well and have been identified as having the potential for indirect wetland effects described above. At the Mine Site, an additional 16 monitoring locations are proposed and are planned within all wetlands that have received effect factor ratings of 2, 3, or 4 near the NorthMet Project area features and in several wetlands with effect factor ratings of 1 that would be located throughout the Mine Site. Within the Plant Site, four new wells are proposed and would include a variety of wetland community types and occur throughout all areas of potential indirect impact factors.~~ The monitoring wells were ~~are~~ planned within all wetlands with effect factor ratings of 3 and within a sampling of wetlands with effect factor ratings of 1 and 2 located throughout the areas of potential indirect wetland effects. ~~Within the Transportation and Utility Corridor, three new monitoring locations are proposed within wetlands that have effect factor ratings of 1 (PolyMet 2013q).~~

As noted in the Section 404 permit application, PolyMet proposes to install shallow water table monitoring wells ~~would be installed~~ at each of the proposed wetland monitoring locations shown in Figures 5.2.3-31 and 5.2.3-32. Each monitoring location would have one recording well and one manual well; if any wells were to become damaged, PolyMet would replace the wells as soon as practical to maintain data continuity. Monitoring would continue in all of the existing wells, with the exception of wells #1 and #6. These two wells would be moved outside of areas that would be directly impacted (Figures 5.2.3-31 and 5.2.3-32). Hydrologic monitoring would continue at the existing and proposed monitoring locations and at reference wetland locations every year throughout the growing season for the life of the mine operation. PolyMet would review the monitoring information and if it is determined that certain wells are not providing useful information, the monitoring plan may be modified with the concurrence of the USACE and MDNR.

Reference Wetland Hydrology Monitoring Sites

Pre-project monitoring locations would include three reference wetlands, one within each major Project area (Figures 5.2.3-31 and 5.2.3-32), approved by the USACE and MDNR to document the natural hydrologic fluctuations in wetlands that would not be affected by the NorthMet Project Proposed Action and would facilitate interpretation of the NorthMet Project Proposed Action hydrologic data. ~~More details on the reference wetland locations are provided in the Section 404 permit application. Water monitoring is discussed in Section 5.2.2.3.6. Water quality would be monitored downstream and piezometers would be located in the wetlands.~~

Wetland Vegetation and Boundary Monitoring

In addition to hydrology monitoring, wetland vegetation monitoring would be conducted during the operation of the NorthMet Project Proposed Action. Baseline conditions for wetland vegetation would be established during the first growing season after permit issuance and at 5-year intervals throughout the life of the mine. Data would be used to document potential shifts in vegetation that are inconsistent with changes documented in the reference wetlands. Baseline data already available from existing plots, wetland delineation, monitoring, and other on-site studies may also be used to document baseline conditions, if these data may help to determine the cause of changes in vegetation characteristics or to demonstrate natural variability within the wetlands (PolyMet 2013q).

PolyMet has also proposed that portions of the monitored wetlands be reviewed every 5 years, concurrent with the vegetation monitoring, to evaluate wetland boundaries. Wetland boundaries would be field-delineated and located using a GPS with sub-foot horizontal accuracy. The field-based delineation would map at least 25 percent of the wetland boundary at each of the wetlands with monitoring locations. The boundaries would be mapped on a rotating basis to include 25 percent of the wetland boundary every 5 years, including some overlap every 10 years. A transect composed of at least two wetland delineation sample points would be completed along a sections of the boundary reviewed in each of the monitored wetlands (PolyMet 2013q).

The delineation data would be compiled to map the boundary of each of the wetlands with monitoring locations. Based on the portion of the wetland that is delineated, the whole wetland boundary would be mapped using desktop review of current aerial photography, topography (LIDAR or site-specific data), and hydrology monitoring data. The results would be reported to the USACE and MDNR at the end of each year of monitoring (PolyMet 2013q).

Criteria Impacts Threshold Levels

The hydrology, vegetation, and wetland boundary monitoring data collected as part of the proposed monitoring program by PolyMet would be evaluated to determine if adverse, indirect wetland effects occur as a result of the NorthMet Project Proposed Action. PolyMet has proposed the following criteria threshold levels for indicating if an adverse, potential indirect wetland effects are occurring (PolyMet 2013q):

- A 50 percent reduction of the baseline wetland hydrology hydroperiod. Antecedent precipitation and reference wetland hydrology would be considered in the evaluation of wetland hydrology hydroperiod. The hydroperiod of a wetland is equal to the length of time and portion of the year the wetland holds ponded water or saturation within 12 inches of the soil surface. This period of time generally varies from year to year based on climatic conditions. Therefore, the judgment of surpassing this threshold would be evaluated considering the monitoring for each wetland conducted during the pre-project time period and data from reference wetlands of similar community types or hydrologic regime.
- A change in vegetation species composition of 25 percent or greater in one or more strata that is inconsistent with vegetation changes in the reference wetlands. For instance, if stinging nettles (*Urtica dioica*) cover changed from 5 to 30 percent, it may indicate changes in wetland hydrology and would be reviewed carefully relative to the hydrology data. Other factors may contribute to changes in vegetation (disturbances or species introductions) that may be unrelated to changes in wetland hydrology or the nearby NorthMet Project Proposed Action; such factors would be considered as appropriate.
- Loss of wetland area (as defined by the wetland boundary determination) that is inconsistent with wetland area loss at reference wetlands.

The above criteria have been proposed by PolyMet as part of their Section 404 permit application and permit conditions would indicate the final criteria thresholds, if the NorthMet Project Proposed Action were approved. The criteria will also be considered and approved during the WCA permitting process and Section 401 certification process. These criteria or those that are approved during permitting would be evaluated by PolyMet with consideration of the NorthMet Project Proposed Action activities and likelihood that such activities are responsible for the changes. Should adverse, indirect wetland effects be identified during the monitoring program, an estimation of such effects would be included in the monitoring report in the year that they are first detected. The data for hydrology, vegetation, and wetland boundary monitoring would be compiled in a report, including methods, results, and evaluation of potential adverse indirect wetland effects; this report would be submitted to the USACE and MDNR by the end of each monitoring year.

Indirect Effects Mitigation

If it is determined that indirect wetland effects occurred based on the criteria effects threshold levels, PolyMet would work with the appropriate agencies to respond, which could require PolyMet to provide compensatory mitigation for any documented indirect effects. If indirectly affected wetlands require compensatory mitigation, the acreage would be calculated by community type and provided in annual monitoring reports to the appropriate agencies. Compensatory mitigation would be based on WCA requirements and the USACE St. Paul District Policy for wetland mitigation, as well as that identified below.

The excess wetland mitigation credits proposed are expected to be available to compensate for potential indirect wetland effects. PolyMet would follow, if necessary, the general planning approach described previously for contingencies for unsuccessful mitigation, as well as below, to identify, plan, and receive the USACE and state approval of mitigation plans to develop additional mitigation credits. If additional mitigation credits were needed site selection would be consistent with USACE and WCA guidance. PolyMet is proposing to mitigate the compensatory loss of wetland areas as a result of potential indirect effects in accordance with the mitigation ratios that were utilized for direct wetland impacts. In addition, PolyMet has proposed in the Section 404 permit application that partial drainage or other changes to the wetlands that do not result in the wetland loss, but exceed the threshold levels identified above, could be mitigated at a lower ratio depending on the extent and degree of the changes to wetland function. The minimum ratio of mitigation credit PolyMet is proposing to use would be 0.25:1.

Wetlands Adaptive Monitoring Plan

PolyMet has, in their Section 404 permit application, proposed utilizing an adaptive monitoring plan approach to evaluate the most effective monitoring strategy for potential indirect effects. Their proposed wetland adaptive monitoring plan outlined below, needs to be reviewed and approved prior to permitting:

- Monitoring plan would be updated annually based on results from the previous year.
- Monitoring plan criteria would be included in the Wetland Management Plan, which would contain all criteria and permit conditions.
- If indirect impacts were observed, additional monitoring may be developed to focus in those areas and/or to focus on a specific impact factor.
- Additional monitoring may include new monitoring locations in other wetlands and more detailed delineation and vegetation data collection.

PolyMet's current proposed adaptive monitoring plan includes two phases. Phase I of the adaptive monitoring plan would be broad-based monitoring to identify changes to wetlands or changes that may affect wetlands or surface waters. Phase II monitoring may be implemented to provide a more detailed assessment in a given area to analyze a potential impact factor. If necessary, the Phase II monitoring would be designed and implemented as needed to address the changes identified during Phase I monitoring. Phase II would be used to determine the need for additional mitigation or to develop a plan to control the changes identified during Phase I and minimize future effects on wetlands. The adaptive monitoring plan would be reviewed and approved during permitting.

~~5.2.3.3.5~~5.2.3.3.6 **Reporting**

Reports would be compiled to document pre-project hydrology conditions and restoration outcomes from the three mitigation sites as well as for the hydrology monitoring at the NorthMet Project areas~~activities at the off- and on-site wetland mitigation projects~~, which would be implemented to fulfill the requirements for compensatory mitigation.

Off-site Monitoring Reports for Wetland Restoration

Reports have been prepared to document the activities that would be conducted at the off-site wetland mitigation sites, which include information regarding existing conditions at the site, construction activities, management activities, wetland restoration goals, performance standards, schedules, and monitoring plans (~~Barr 2008m; Barr 2011k~~PolyMet 2014h; PolyMet 2014i; PolyMet 2014j). These plans were developed to comply with WCA rules (*Minnesota Rules*, chapter 8420), Section 404 of the CWA as administered by the USACE, and *Minnesota Rules*, part 7050.0186 (wetland mitigation) as administered by the MPCA.

~~A p~~Project-specific wetland mitigation plans for three mitigation sites ~~Zim was~~ were prepared that describes the compensatory wetland mitigation that would be used to replace unavoidable wetland ~~effects~~ impacts associated with the NorthMet Project Proposed Action. The ~~preliminary~~ wetland mitigation plans ~~was~~ were updated and submitted to the USACE in ~~November 2011~~ May 2014 for the three sites~~(PolyMet 2013b)~~.

PolyMet would submit progress monitoring reports for the wetland mitigation sites as determined during permitting, to document restoration outcomes. Wetland restoration construction progress would be tracked along with compliance with permit conditions. The reports would describe the status of the wetland mitigation, summarize the results of the vegetation and hydrology monitoring, discuss management activities and corrective actions conducted during the previous year, and discuss activities planned for the following year. The monitoring report completed after the tenth growing season would assess whether or not the restoration were sufficiently complete and if additional monitoring and reporting were warranted (PolyMet 2015c).

~~A wetland restoration plan for Hinckley and Aitkin was prepared describing the compensatory wetland mitigation that would be used to replace unavoidable wetland effects associated with the NorthMet Project Proposed Action. Preliminary wetland restoration plans were submitted to the USACE and MDNR Division of Lands and Minerals in August 2007 (PolyMet 2013b).~~

Reporting on Mine Site and Plant Site Wetland Hydrology for Potential Indirect Effects

Pre-project wetland hydrology monitoring reports, generated to meet reporting requirements, have been compiled and document 5 years of pre-project planning and monitoring at the Mine Site (2005 to 2009). PolyMet has continued to conduct wetland hydrology monitoring since 2009 at the Mine Site. Pre-project wetland hydrology monitoring at the Plant Site has also been conducted in ~~for years 1, 2, and 3 (~~2010, 2011, and 2012~~)~~ at the Plant Site and is ongoing. Future project wetland hydrology monitoring reports would be submitted in accordance with any permit issued.

Monitoring data would be submitted to the USACE and MDNR annually for the life of the mine. Hydrology data would be presented every year to show monitoring locations, hydrographs, and analysis of wetland hydrologic conditions in the context of precipitation conditions. Vegetation and wetland boundary data would be presented every 5 years and would be used to determine the acreage of impacts and potential indirect effects that were not evident based on hydrologic data. Indirect effects would be assessed in the annual reports to the extent possible. Acreage of indirect effects, if any, would be determined and would be used to determine the requirements for wetland mitigation credits, if such credits were needed. If compensatory mitigation were necessary, credits would be proposed in the annual report as described above (PolyMet 2013q).

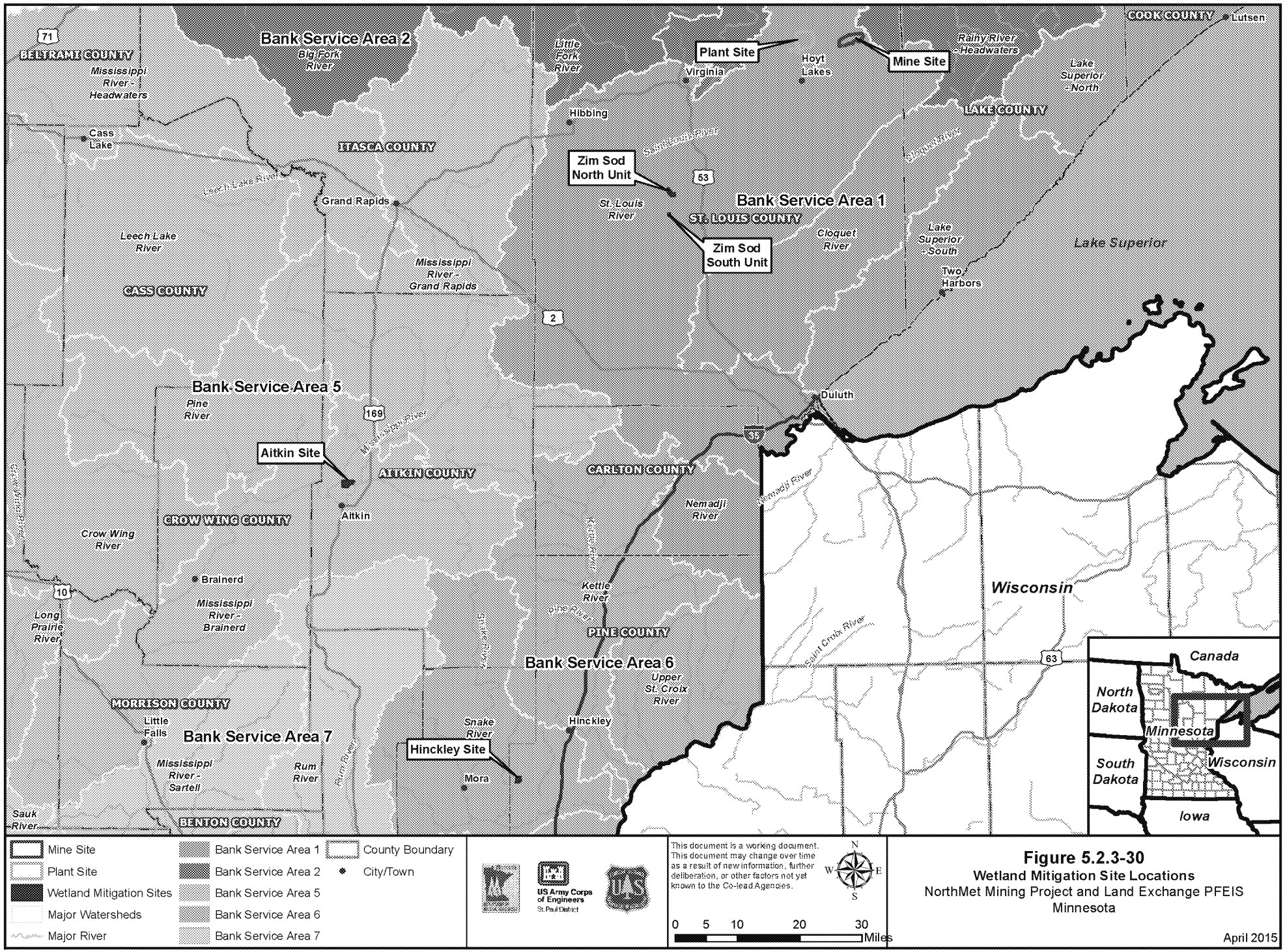

Figure 5.2.3-30
Wetland Mitigation Site Locations
NorthMet Mining Project and Land Exchange PFEIS
Minnesota

April 2015

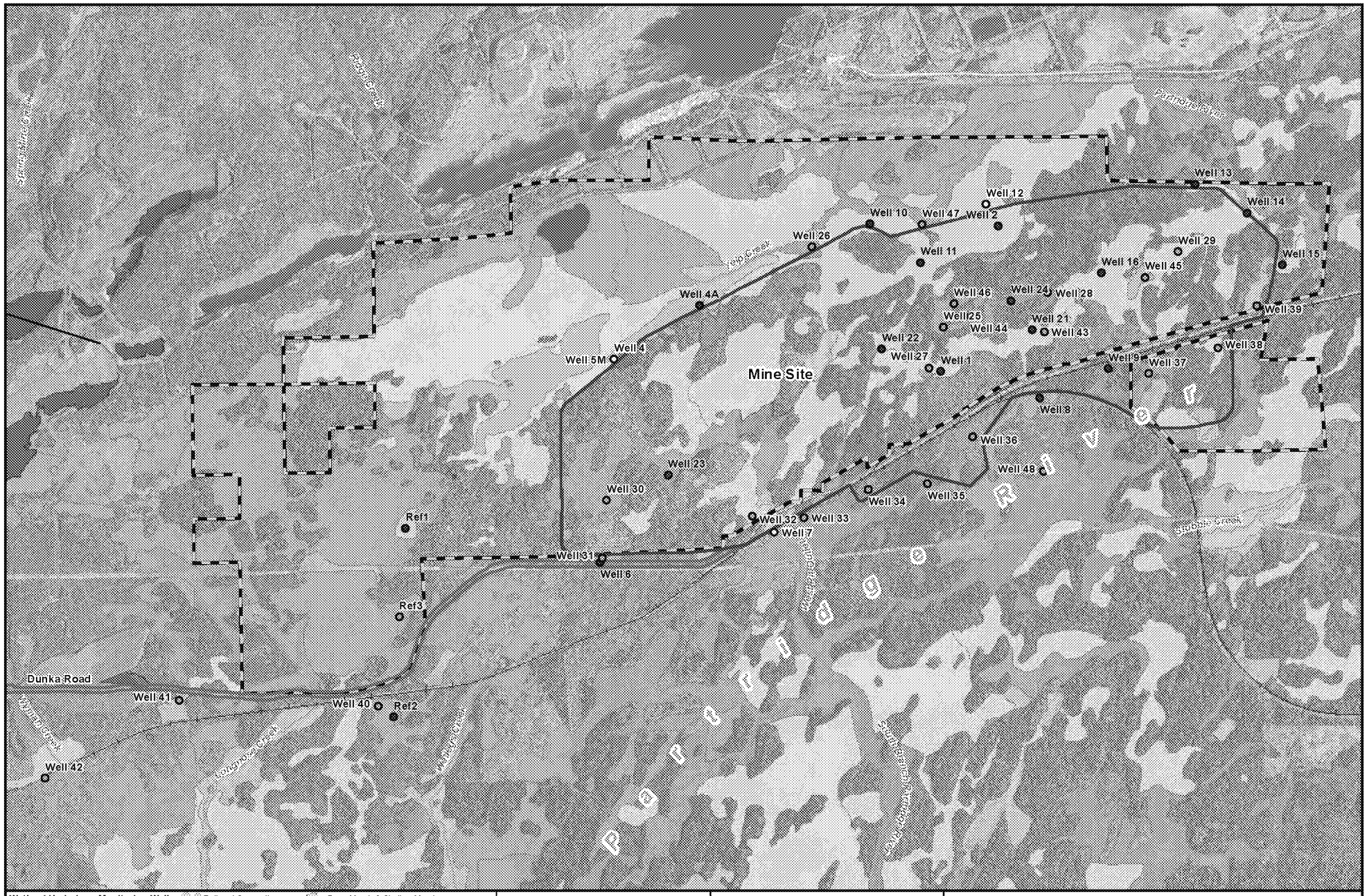

Figure 5.2.3-31
Mine Site Wetland Hydrology Monitoring Well Locations
NorthMet Mining Project and Land Exchange PFEIS
Minnesota
April 2015

Figure 5.2.3-32
Plant SIte Wetland Hydrology Monitoring Well Locations
NorthMet Mining Project and Land Exchange PFEIS
Minnesota

April 2015